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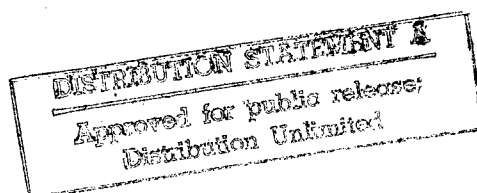


# ***JPRS Report***

# **Science & Technology**

***USSR: Chemistry***

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# Science & Technology

## USSR: Chemistry

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**Volt-Ampere Determination of Selenium Dioxide and Zinc Selenide in Air**

917M0137D Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 57 No 5, May 91 (manuscript received 13 Dec 89) pp 523-527

[Article by S.A. Kozina, N.F. Falendysh, and V.V. Lukachina, Institute of Colloidal Chemistry and Water Chemistry, UkSSR Academy of Sciences]

UDC 546.23+546.47:543.253

[Abstract] In view of the importance of monitoring levels of selenium compounds in air, the authors of the study reported herein worked to develop a method for the volt-ampere determination of selenium dioxide and zinc selenide in air by using a mercury film-coated glass carbon electrode. The studies were conducted on a PU-1 polarograph with a three-electrode cell. A disk electrode made of SU-2000 glass carbon was used (its working surface amounted to 0.03 cm<sup>2</sup>). The method entails using cathode inversion volt-ammetry to determine selenium (IV) and anode inversion volt-ammetry with accumulation to determine ZnSe based on zinc (II). The lower bound of determinable concentrations under the conditions studied amounts to 5 x 10<sup>-7</sup> mol/l for selenium and 5 x 10<sup>-8</sup> mol/l for zinc. Adding oxalic acid to the sulfuric acid solution used to determine selenium (IV) was found to reduce the minimum detectable concentration from 1 x 10<sup>-6</sup> M to 5 x 10<sup>-7</sup> M. A background electrolyte with the following makeup was found to yield the best results with respect to determining zinc (II): 1 M NH<sub>4</sub>OH, 0.2 M Na<sub>2</sub>SO<sub>4</sub>, 0.5 M ethylene diamine, 1.6 x 10<sup>-5</sup> M H<sub>2</sub>C<sub>2</sub>O<sub>4</sub>, and 5 x 10<sup>-5</sup> M Hg (II). The procedure developed to determine selenium dioxide entails the use of a formula that is included. The method developed may be used to monitor the content of selenium compounds in the air at industrial enterprises. Figures 3, table 1; references 11: 8 Russian, 3 Western.

**Theoretical Computation of the Electric Conduction of Concentrated Acid Solutions**

917M0137F Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 57 No 5, May 91 (manuscript received 6 Jul 90) pp 557-558

[Article by Yu.Ya. Fialkov, V.L. Chumak, and Ye.S. Bondarenko, Kiev Polytechnic Institute]

UDC 541.31

[Abstract] Mean spherical approximation is one of the most productive approaches to describing the transport processes of electrolyte solutions. For this reason, the authors of this concise report have proposed a method for theoretical computation of the isotherms of the electric conduction of solutions of hydrogen acids with a concentration of up to 10 M that is based on the theory of mean spherical approximation. Into the equations for

the latter, the authors introduce dependences of dielectric permeability and viscosity on the concentration of the electrolyte solution. The method presented makes it possible to compute electric conduction isotherms all the way up to concentrations of 10 M l<sup>-1</sup>, which is significantly better than the upper concentration bound describable by all other theories of the electric conduction of solutions. The mean square deviation of computed quantities from the experimentally determined quantities did not exceed 5% in any of the systems examined by the authors. Figure 1; references 7: 3 Russian, 4 Western.

**Extraction-Chromatographic Determination of Acids and Their Salts in Water**

917M0158A Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 46 No 5, May 91 (manuscript received 15 May 90) pp 943-950

[Article by I.N. Stankov, A.N. Beresnev, and S.N. Lanin, State Union Scientific Research Institute of Organic Chemistry and Technology, Moscow, and Moscow State University imeni M.V. Lomonosov]

UDC 543.544.2:547.661.73

[Abstract] After briefly reviewing the problems inherent to the three most frequently used techniques of gas chromatographic determination of acids in water, the authors of the study reported herein propose a general method to determine carboxylic, organophosphoric alkylsulfuric, and other acids in water. To extract the aforesaid acids from a 1- to 2-ml aqueous solution (containing 0.01 to 5% [by weight] of the acid in question), the authors add between 0.05 and 0.1 ml amine and 0.1 to 1 ml hydrophilic proton-donor solvent. Next, they add K<sub>2</sub>CO<sub>3</sub> or (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> as a salting-out agent until two phases are formed. The upper (organic) layer is drawn off and processed with a diazoalkane solution. The resultant esters are then subjected to chromatographic analysis. The proposed method has been tested successfully in a number of processes entailing the determination of 0.01 to 2% (by weight) acid in rinse waters and sewage. Figure 1, tables 4; references 26: 11 Russian, 15 Western.

**Determining Synthetic Surfactants in Water in the Presence of Humic Acids**

917M0158B Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 46 No 5, May 91 (manuscript received 8 May 90) pp 951-957

[Article by I.Yu. Andreyev and Ye.B. Zinovyeva, Leningrad State University]

UDC 547.992:661.185.1:66.081.3

[Abstract] The extraction-photometric methods that are generally recommended for use in determining the content of synthetic surfactants in natural and waste waters

are fraught with several problems. Other organic compounds that are present in the waters undergoing analysis may also react with the dyes used in extraction-photometric determination methods and may thus interfere with the analysis results. Because humic acids (which may be looked upon as natural surfactants) constitute the basis of the organic matter present in natural waters, the authors of the study reported herein examined the effect of humic compounds on the determination of synthetic surfactants. They also examined the possibility of sorption separation of humic compounds from synthetic surfactants. During the course of their experiments, the authors used a humic acid preparation that was recrystallized from commercial reagent. As representative cationic, anionic, and nonionogenic synthetic surfactants they used bromide cetyltrimethylammonium [CTA], sodium laurylsulfate [LS], and OP-7, respectively. Carbon fiber and a polyethylene polyamine-modified polyacrylonitrile [PAN-PAE]-based sorbent were used for sorption separation of the humic compounds from the synthetic surfactants. The standard extraction-photometric method was used to determine the synthetic surfactants. The said procedure was based on chloroform extraction of three different ionic associates: laurylsulfate with methylene blue, CTA with bromophenol blue, and OP-7 with cobalt rhodanide. During the course of their experiments, the authors established that synthetic surfactants in aqueous solutions do indeed react with humic acids and with the dyes used for extraction-photometric determination of synthetic surfactants. The experiments attempting sorption separation of the humic compounds from the synthetic surfactants revealed that the sorption of LS and CTA was virtually quantitative over a wide pH interval from 0 to 11. The PAN-PAE-based sorbent did not absorb OK-7, whereas the carbon fibers absorbed 85 to 90%. Humic acids were extracted by both sorbents in an acid medium ( $\text{pH} \leq 3$ ), with the PAN-PAE-based sorbent extracting 95 to 100% and the carbon fiber extracting between 60 and 80%. The authors proceeded to develop a procedure for using PAN-PAE fiber to develop and describe in detail a method of determining synthetic surfactants in waters in the presence of humic acids. Figures 4, tables 2; references 5 (Russian).

#### **Voltammetric Determination of the Pesticides Carbathion and Amoben by Using a Carbon-Paste Electrode**

917M0158C Moscow ZHURNAL ANALITICHESKOY KHMII in Russian Vol 46 No 5, May 91 (manuscript received 5 Feb 90) pp 962-966

[Article by E.P. Medyantseva, N.A. Ulakhovich, G.K. Budnikov, and A.T. Groyberg, Kazan State University imeni V.I. Ulyanov-Lenin]

UDC 543.253:632.95

[Abstract] Sodium methylthiocarbamate (carbathion) and ammonium ethylene-bis-dithiocarbamate (amoben) are widely used as pesticides and are

thus potential contaminants of natural waters. Various physicochemical methods, including voltammetric methods, are currently used to determine these pesticides. In view of the low selectivity of all of the currently available determination methods, the authors of the study reported herein studied the possibility of selective determination of carbathion and amoben by using a coal-paste electrode or by using a coal-paste electrode modified by cobalt (II) dimethyldithiophosphate. The authors developed a selective method for voltammetric determination of up to 0.007 mg/l carbathion in the presence of amoben, nabam, eptam, tillam, and cineb and their metabolites based on the catalytic wave of hydrogen evolution at a Co (II) dimethyldithiophosphate-modified coal-paste electrode. They then proceeded to develop a procedure for voltammetric determination of amoben based on its oxidation current. The method has a lower determination limit of 0.75 mg/l in the presence of comparable amounts of carbathion. The correctness of the determination methods developed was estimated by varying the mass of the samples, adding quantities of the component being determined, and then determining the system and proportional systematic errors. A comparison of the values obtained with the t-test for the standard deviation indicated that the methods do not have a significant systematic error and may thus be considered correct. Figures 2, tables 2; references 10: 8 Russian, 2 Western.

#### **Determining the Bulk Chemical Composition of Polymetal Samples by Raster Scanning**

917M0158D Moscow ZHURNAL ANALITICHESKOY KHMII in Russian Vol 46 No 5, May 91 (manuscript received 20 Mar 90) pp 967-974

[Article by A.A. Ulyanov, N.N. Kononkova, and N.N. Korotayeva, Moscow Geochemistry and Analytical Chemistry Institute imeni V.I. Vernadskiy, USSR Academy of Sciences, and Moscow State University imeni M.V. Lomonosov]

UDC 543.422.8

[Abstract] Defocused bulk analysis [DBA] and raster surface scanning [RSS] are frequently used to determine the chemical composition of polymetal samples. In some cases, these methods result in significant errors associated with the fact that the results of the standard procedure for ZAF correction of the element content are expressed in terms of percentages by weight, whereas the DBA and RSS methods entail recording x-ray quanta from the different mineral phases proportionally to their areas. An algorithm has been proposed for computing a modified ZAF correction that would allow for the differences in the densities of the different mineral phases of a polymetal sample. The suitability of this algorithm for use with fine-grained polymetal specimens remains a point of dispute, however. In view of this fact, the authors of the study reported herein attempted to experimentally verify the precision of data obtained when the



RSS method is used to analyze fine-grained polymineral samples. They investigated a relatively large section of the melilite-perovskite zone of a gibbonite-containing inclusion of the Yefremovka chondrite (the difference between the densities of the melilite and perovskite amounts to about 25%). The studies performed confirmed that raster surface scanning yields satisfactory results when used in the elemental analysis of fine-grained polymineral samples. The standard procedure for ZAF correction proved to be suitable indeed when used for purposes of such an analysis. It was further determined that when a microprobe is used, the scanning area must not exceed  $50 \times 50 \mu\text{m}$ . Its upper threshold when a scanning electron microscope is used has not been precisely established but may, according to the authors, be estimated at more than  $1,000 \times 1,000 \mu\text{m}^2$ . Figures 3, tables 6; references 5: 2 Russian, 3 Western.

**Identification of the Superconductive Properties of the Ceramic High-Temperature Superconductor  $\text{YBa}_2\text{Cu}_3\text{O}_{6.5 \pm x}$**

917M0158E Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 46 No 5, May 91 (manuscript received 5 Feb 90) pp 976-980

[Article by A.A. Kaplin (deceased), N.M. Svishchenko, N.M. Dubova, G.B. Slepchenko, Yu.A. Karbainov, and G.F. Ivanov, Tomsk Polytechnic Institute]

UDC 543.253

[Abstract] The authors of the study reported herein used the method of solid-phase voltammetry to examine the electrochemical behavior of specimens of the ceramic high-temperature superconductors [HTSC]  $\text{YBa}_2\text{Cu}_3\text{O}_{6.5+x}$ , which contains an orthorhombic superconductive phase, and  $\text{YBa}_2\text{Cu}_3\text{O}_{6.5-x}$ , which contains a tetragonal phase without superconductive properties). Their studies enabled them to develop a simple technique for qualitative identification of the superconductive properties of ceramic HTSC based on voltammetric curves obtained against the background of 0.5 M KCl (pH, 2) at ambient temperature in a differential-pulse mode by using a carbon-paste electrode. The method developed is deemed very promising for use in assessing the superconductive properties of thin films. Figures 5, table 1, references 6 (Russian)

**Using Secondary-Ion Mass Spectrometry To Study Surface Contamination of Ultrapure Substances**

917M0158F Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 46 No 5, May 91 (manuscript received 20 Dec 89) pp 981-988

[Article by N.N. Yekzhanov and A.G. Lototskiy]

UDC 543.064:543.51

[Abstract] Secondary-ion mass spectrometry [SIMS] is one of the most promising methods of determining

surface contaminants. It boasts a low detection threshold, can be used to determine a broad set of elements, and affords high local and layer-by-layer resolution. The method is, however, fraught with several problems. This is especially true when it is used to analyze high-ohm and dielectric materials, in which case difficulties arise that are related to the local charging of the specimen surface by the beam of secondary ions and changes in the elemental makeup of the surface at the analysis site. In an effort to solve this problem the authors worked to develop a universal method of determining a broad set of surface contaminants of ultrapure substances. By performing a series of experiments, they developed a technique for multielemental quantitative surface analysis of ultrapure materials (including metals, semiconductors, and insulators) by the SIMS method. To compensate for the aforementioned charging of the specimen surface, they used a fast xenon atom bombardment source and a photographic detection mass spectrometer to obtain secondary-ion mass spectra. They tested 27 elements. A mass resolution of about 5,000 was achieved, and the detection limits for the different elements examined ranged from  $10^{10}$  to  $10^{13}$  atoms per  $\text{cm}^2$  (about  $10^{-5}$  to  $10^{-2}$  of a monolayer). The capabilities of the technique developed are illustrated by way of the example of analysis of gallium arsenide, germanium, silicon, niobium, and quartz surfaces and by way of the analysis of the surface distribution of boron and sodium on silicon wafers. The method developed is thus recommended for use in investigating the nature of the distribution of impurities and estimating the geometric dimensions of microinclusions in the surface layers of a sample. Figures 4, tables 3; references 9: 4 Russian, 5 Western.

**Determining Total and Noncomplexed Ethylenediaminetetraacetate in Technically Important Electroplating Solutions**

917M0158G Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 46 No 5, May 91 (manuscript received 5 Mar 90) pp 989-992

[Article by V.P. Vasilyev, V.I. Shorokhova, A.V. Katrovitseva, and S.Ye. Solovyeva, Ivanovo Chemical Technology Institute]

UDC 543:541.135.2

[Abstract] Ethylenediaminetetraacetate [EDTA] salt-containing electrolytes have recently become very popular in electroplating technology. Because the quality of electroplated coatings produced by using EDTA-containing solutions depends on maintaining a constant concentration of EDTA in the solution and because the literature does not contain any general recommendations for determining the EDTA content in electrolyte solutions, the authors of the study reported herein

worked to develop a method of determining the total and noncomplexed EDTA in electrolyte solutions. They proceeded to develop a method of selecting titrants to determine the free and noncomplexed EDTA in copper-, nickel-, and cadmium-plating solutions. After settling upon  $\text{FeCl}_3$  as a titrant to determine total EDTA and  $\text{NiSO}_4$  and  $\text{ZnSO}_4$  as titrants to determine free EDTA, the authors then proceeded to develop a technique for determining the total and free EDTA in copper-plating solutions. Tests of the determination method's accuracy by the add-and-find technique confirmed that the results yielded by the proposed method are entirely satisfactory. Table 1; references 9: 7 Russian, 2 Western.

#### Coulometric Generation of Ce (IV) To Determine Selected Pharmaceuticals

917M0158H Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 46 No 5, May 91 (manuscript received 3 Apr 90) pp 993-998

[Article by M.A. Bufatina, I.F. Abdullin, and G.K. Budnikov, Kazan State University imeni V.I. Ulyanov-Lenin]

UDC 543.258

[Abstract] Cerium (IV) that has been electrically generated in aqueous acid solutions has long been known as a coulometric titrant. In a continuation of the research that has been done on both Ce (IV) and Ce (III), the authors of the study reported herein examined the behavior of the system Ce (IV)/Ce (III) in acetic acid against a background of perchloric acid and assessed the possibility of using electrogenerated Ce (IV) for purposes of determining selected pharmaceuticals. The electrochemical generation of Ce (IV) from  $\text{Ce}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$  was studied on platinum and graphite electrodes in glacial acetic acid in various concentrations of perchloric acid. A PI-50-1.1 potentiostat was used to obtain voltammetric curves. The exact concentration of Ce (III) in the solutions was determined by titration of a standard ethylenediaminetetraacetic acid [EDTA] solution with a xylene orange indicator. A well-expressed wave of oxidation of Ce (III) to Ce (IV) was observed in the polarization curves of a platinum electrode in acetic acid containing  $\text{Ce}(\text{NO}_3)_3$  against a background of 0.5 M  $\text{HClO}_4$ . The threshold current was found to be proportional to the concentration of depolarizer. In the range of potentials from 1.9 to 2.1 V, the current efficiency was virtually quantitative. The polarization curves for the case of the graphite electrode were analogous; however, the quantitative current efficiency was observed in a narrower range of potentials (1.2 to 1.4 V). The electrogenerated Ce (IV) was determined to be suitable for use

in coulometric determination of hydrazides of certain acids (isonicotinic, diphenylphosphinyl acetic, m-nitrobenzoic, and valeric) and sulfamides (norsulfazole, sulfadimethoxine, sulfamonomethoxine, sulfaguanidine, and sulfaethidole) with detection limits between 0.3 and 3.0  $\mu\text{g/ml}$  and with relative standard deviations of 0.012 to 0.1 (depending on the type of compound). Figures 2, tables 4; references 6: 3 Russian, 3 Western.

#### An Electrochemical Morphine Biosensor Based on Rat Brain Opiate Receptors

917M0158I Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 46 No 5, May 91 (manuscript received 31 May 90) pp 999-1003

[Article by D.M. Ivnit'skiy, I.N. Kurochkin, S.D. Varfolomeyev, M.F. Yulayev, and A.G. Kuznetsov, Samarkand Medical Institute]

UDC 543.866:541.13

[Abstract] The authors of the study reported herein developed a solid-state electrochemical morphine biosensor that is based on membrane preparations of rat brain opiate receptors. The receptor electrode was manufactured as follows. A platinum wire 0.5 m in diameter and 6 mm long was subjected to alternating anodic-cathodic activation at potentials of hydrogen and oxygen evolution. The platinum's surface was coated with a 0.05-mm-thick nitrocellulose film and impregnated with a mixture (1:1) of phosphatidyl choline and cholesterol in chloroform (50 mg/ml). Opiate receptor membrane preparations were built into the lipid membrane by incubating the electrode in an aqueous suspension of the preparations (1 mg/ml) in a medium containing 5 mM HEPES, 150 mM KCl, 15 mM NaCl, and 5 mM  $\text{CaCl}_2$  (pH, 7.5). The association time amounted to 10 hours at  $+4^\circ\text{C}$ , and the resistance of the electrodes with the lipid membrane amounted to  $6.5 \times 10^6 \text{ ohm/cm}^2$ . The receptor electrode's operation is based on the following principles: integral protein receptors are capable of quickly, specifically, and reversibly complexing with a specified ligand; complexing is accompanied by conformational restructuring of receptors leading to transmembrane ion transfer; and the matrix of a lipid membrane is relatively impermeable for ions because the ions' electrochemical gradient goes to zero in the case of high ionic permeability. The morphine detector has a detection threshold of  $1.4 \times 10^{-6} \text{ mol/l}$ , and 10 minutes is required to perform an analysis using the detector. Data obtained during studies of the effect of pH, ionic strength of the solution, and nature of the electrolyte on the magnitude of the receptor electrode's analytic signal are also included. The mechanism of the biosensor's operation is also discussed. Figures 4; references 12: 5 Russian, 7 Western.

**Problems of Ecology and Effectiveness of  
Pyrolysis Production**

917M0095A Moscow GIDROLIZNAYA I  
LESOKHIMICHESKAYA PROMYSHLENNOST  
in Russian No 2, Mar-Apr-May 1991 pp 1-4

[Article by V. I. Kamennyy]

UDC 630\*863: [628.543+628.512]

[Abstract] The study showed the direct dependence of solution of ecological problems related to the hydrolysis industry on the increase of effectiveness of hydrolysis production, technical renovation and improvement of technology. The present situation in the hydrolysis industry involving a complex chain of processes and apparatus to produce 1 or 2 kinds of production and 1 or 2 side products if this can be done economically should be replaced by assessment of hydrolysis production from the position of a market economy which will provide a completely new approach to hydrolysis production. A complex program, developed at the Archangel Hydrolysis Plant indicated that expenditure of 4 million rubles to solve ecological problems will have an economic impact of more than 5 million rubles per annum. Some measures being taken to increase hydrolysis production while improving the environmental situation were mentioned and discussed briefly. References 22 (Russian).

**Behavior of Lignosulfonates in Ground Waters**

917M0095B Moscow GIDROLIZNAYA I  
LESOKHIMICHESKAYA PROMYSHLENNOST  
in Russian No 2, Mar-Apr-May 1991 pp 4-6

[Article by D. P. Moseyeva, N. A. Rubtsova, L. M. Bogdanovich et al.]

[Abstract] Lignosulfonic acids [LSK] were separated from ground waters with the use of macroporous anionite of diethylaminoethylcellulose. A spectrophotometer SF-46 measured the natural density of the natural waters at 280 nm and recorded the ultra-violet spectra. Molecular-mass distribution of samples were determined with the use of exclusion liquid chromatography on a "Milikhrom" chromatograph. Partial humification of lignosulfonates occurred during long stay of them in underground waters. Comparison of LSK separated from ground waters with LSK of the initial liquor showed that natural factors changed the ultra-violet and infra-red spectral properties of LSK and changed their functional composition. Molecular-mass characteristics remained practically unchanged. The results of the study may be used to select an optimal method of determining lignosulfonates after their long stay in ground waters. A method of extracting LSK from ground waters with a lignosulfonate content of the order of several mg/l with the use of macroporous anionite of DEAE-cellulose was proposed. Figures 4; references 4 (Russian).

**Determination of Maleic Anhydride Content in  
Terpene Maleic Resins and in Waste Waters  
From Their Production**

917M0095C Moscow GIDROLIZNAYA I  
LESOKHIMICHESKAYA PROMYSHLENNOST  
in Russian No 2, Mar-Apr-May 1991 pp 6-7

[Article by A. I. Lamotkin and A. N. Pronevich; Belorussian Technological Institute]

UDC 630\*866.5.002.33:547.441

[Abstract] A gas-liquid chromatography method developed by the authors for determining the content of free maleic anhydride in terpene maleic resins [TMR] and in waste waters from their production was described and discussed. The chromatogram showed the presence of traces of free maleic anhydride, indicating the effective degree of distillation by live steam of the non-reacting maleic anhydride during production. The accuracy of the method was assessed by analyzing mixtures composed of TMR containing no maleic anhydride with additives of maleic anhydride with consideration of its fraction of total mass in the initial sample. Relative error of determination of free maleic anhydride in TMR by this method did not exceed 4 percent. The relative error of determination of maleic anhydride in distilled water was 6 percent, on the average. The method can be used in TMR quality control and in determination of maleic anhydride in waste waters. Figures 3; references: 3 (Russian).

**Production of Nutrient Medium by  
High-temperature Hydrolysis of Activated Sludge**

917M0095D GIDROLIZNAYA I  
LESOKHIMICHESKAYA PROMYSHLENNOST  
in Russian No 2, Mar-Apr-May 1991 pp 8-10

[Article by L. V. Sokolova, N. D. Khomenko, A. M. Filatova et al.; Northern-Caucasus Branch of the All-Union Scientific Research Institute of Protein Synthesis]

UDC 628.543.8

[Abstract] A study of activated sludge cultivated on post-yeast hydrolysis must of the Krasnodar Chemical Combine on a laboratory device for continuous cultivation of microorganisms "Ankum-2M" was described and discussed. The amino acid composition of the sludge, determined on an amino acid analyzer "ND-1200E", showed the presence of practically all irreplaceable amino acids. The sludge was especially rich in aspartic and glutamic amino acids. Addition of hydrolyzates of active sludge to substrates for growing fodder yeasts significantly increased their biological quality. The study made possible development of a flow chart of utilization of excess activated sludge after biological treatment of the post-yeast must. Excess activated sludge was dried on a flotator-settling tank and subjected to high-temperature

hydrolysis on a continuous action device. The hydrolyzates of activated sludge entered a neutralizer and was mixed with the flow of hydrolyzate of plant raw material and, after appropriate preparation, underwent biochemical conversion. The method made it possible to utilize large-tonnage waste and increased the yield of fodder yeasts from RB by 3-6 percent. Calculations based on the situation at Krasnodarsk Chemical Combine showed that conversion of excess activated sludge by high-temperature hydrolysis ensured a concentration of amine nitrogen in the mash of nearly 40 mg/l which can increase the yeasts yield from RB by 3 percent absolute and provide nearly 300 tons additional production of yeasts per annum. Figure 1; references 4 (Russian).

#### **New Metal Detector For Protecting Equipment Used to Process Logs**

917M0095D Moscow *GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST* in Russian No 2, Mar-Apr-May 1991 p 19

[Article by I. G. Koloshkin and A. Ye. Leshchuk; All-Union Scientific Research Institute of Hydrolysis]

UDC 630\*863.1.002.5

[Abstract] A metal detector for log conveyors which includes an electronic unit of the MP-2S metal detector and a flat sensing element which can be placed under the belt conveyor was developed at the All-Union Scientific Research Institute of Hydrolysis. The device detected ferromagnetic objects of no less than 200 g passing through the zone of the sensing element at a height of 150 mm. Substitution of the new flat sensing elements for the 3-dimensional sensing element of the MP-2S metal detectors increased reliability of operation of the metal detector, increased the period of operation of the equipment and improved the quality of the finished production. Vulcanization procedures have been developed to increase the efficiency of sensing devices placed on conveyors with metal fastenings. The new metal detector can be used to protect shredders and saws and to detect magnetic and non-magnetic metal inclusions in ground wood.

#### **Content of Carcinogenic Micromixtures in Products of Hydrolysis Production**

917M0095F Moscow *GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST* in Russian No 2, Mar-Apr-May 1991 pp 21-22

[Article by L. D. Kostenko, N. S. Zlobina and O. I. Kazanova; Chemical-Biological Department; Leningrad Branch of the Scientific Center of Technical Activity, Research and Social Initiatives; USSR Academy of Sciences; Scientific Research Institute of Oncology; Ministry of Health]

UDC 630\*863.1:658.562

[Abstract] Determination of benz/a/pyrene levels in fodder yeasts of some hydrolysis plants included a more detailed study of yeast from the Bobruyskiy Hydrolysis Plant and study of contamination by carcinogenic hydrocarbons of supplementary production of this plant, bacterial biomass of local treatment installations caused by use of a closed water supply system. During strict observance of the technological regime at the hydrolysis plants, the quantity of benz/a/pyrene did not exceed 1 µg/kg of yeasts. Some samples of fodder hydrolysis yeasts showed the presence of N-nitroso amines. This required a prompt search for the cause of this and its elimination. Changes of the technological regime such as the use of a closed water supply cycle could periodically increase the amount of carcinogenic micromixtures found at hydrolysis plants (especially benz/a/pyrene and polycyclic aromatic hydrocarbons) exceeding the present temporary maximum permissible level for fodder yeasts (5 µm/kg). Supplementary production of local treatment installations of Bobruyskiy Hydrolysis Plant contained, on the average, higher levels of benz/a/pyrene (6.9 + or - 0.8 µg/kg) than that found in fodder yeasts (3.7 + or - 1.2 µg/kg). The limits of content of benz/a/pyrene in biological masses of local treatment installations and yeasts were 0.46-14.0 and 0.45-9.1 µg/kg respectively. The findings confirmed the need to monitor the level of carcinogenic micromixtures, especially benz/a/pyrene in yeast produced by hydrolysis and biochemical plants, especially after changes of the technological regime. References 7: 6 Russian; 1 Western.

#### **Transfer of Hydrogen and Hydroxyl Ions Through Ion-Exchange Membranes in Electrodialyzer With Bipolar Membranes**

917M0115A Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 13, No 2, February 1991 pp 99-103

[Article by V. I. Kovalchuk; Institute of Colloid Chemistry and Chemistry of Water imeni A. V. Dumanskiy; UkSSR Academy of Sciences; Kiev]

UDC 541.13:541.183.12

[Abstract] The mechanism of acid and base "leakage" through monopolar membranes in the process of their production in electrodialyzers with bipolar membranes was discussed. The dependence of the hydrogen and hydroxyl ions current through the cation-exchange membrane on the voltage applied with different ratios of salt and base concentration in the adjacent solution was calculated in the Nerst approximation. The overall resistance of the membrane with the diffusion layers changed nonmonotonically, which explains the nature of the dependence of the current on the voltage. The dependence of the hydrogen and hydroxyl ions on the concentration of the base at the outer limits of the diffusion layers during fixed voltage also was nonmonotonic. At low concentrations of the base, the current increased

with the increase of concentration. Later the current began to decrease with the increase of concentration because the resistance of the membrane, which increases, becomes decisive. Figures 3; references 5 (Russian).

**Electroosmotic Sliding of Second Kind on Ion-exchange Fibers**

917M0115B Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 13, No 2, February 1991*  
pp 106-110

[Article by N. A. Mishchuk and P. V. Takhistov; Institute of Colloid Chemistry and Chemistry of Water imeni A. V. Dumanskiy; UkSSR Academy of Sciences; Kiev]

UDC 541.183:541.13

[Abstract] A study of development of a theoretical model of processes ensuing in a system of 2 antipolar fibers and development of their basic regularities showed that electroosmotic second kind sliding arising from strong concentration polarization can induce such strong intensification of extradiusion ion transport that their intradiusion transport will be a limiting factor. Figures 4; References 5 (Russian).

**Reagent Conditioning of Sewage and Circulating Waters During Working of Placer Deposits**

917M0115C Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 13, No 2, February 1991*  
pp 123-127

[Article by S. S. Timofeyev and B. L. Talgamer; Irkutsk Polytechnical Institute]

UDC 622.1:505.55.204

[Abstract] A survey of the literature revealed means and methods of reagent conditioning of circulating waters and sewage during working of placer deposits. Basic coagulants and flocculants recommended for intensification of gravitational sedimentation of finely dispersed clayey suspensions were mentioned and discussed. Advantages and disadvantages of reagents described were discussed. From the ecological standpoint, preference must be given to those methods and means which require minimal doses of coagulants and flocculants. In clearing clayey suspensions from sewage, it is necessary to use doses of flocculants which do not lower water quality nor harm the hydrobionts populating the water. Flocculants must be more completely described with indication of the technological parameters but also the ecological certificate for each reagent recommended for introduction. References 54 (Russian).

**Regularities of Chemosorption of Lithium Ions by Amorphous Aluminum Hydroxide From Chloride Waters**

917M0115D Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 13, No 2, February 1991*  
pp 140-143

[Article by A. Sh. Ramazanov; Institute of Problems of Geothermy; Dagestan Branch of the USSR Academy of Sciences; Makhachkala]

UDC 541.183.57:[546.34/62]+66.081.3

[Abstract] A study of the effect of different physico-chemical factors on chemosorption of lithium by amorphous aluminum hydroxide from chloride solutions used chloride solutions because chloride type brines have the highest lithium concentrations of any natural mineralized waters. Amorphous aluminum hydroxide was produced at  $293 \pm 1^\circ \text{K}$  by interaction of equimolar solutions of  $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$  precipitate and washing by distilled water. The study showed the effect of pH, temperature, and nature and concentration of the background electrolyte on the degree and rate of chemosorption of lithium. The data obtained may be used to select conditions for extracting lithium from chloride type thermal mineralized waters. Figures 5; references 14: 9 Russian; 5 Western.

**Correction of Carbonates Content in Water**

917M0115E Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 13 No 2, February 1991*  
pp 153-162

[Article by L. S. Alekseyev; All-Union Research Institute; All-Union Scientific Research Institute of Water Supply, Channelization, Hydrotechnical Installations and Engineering Hydrogeology]

UDC 628.34

[Abstract] A study of the use of soda ash, carbon dioxide and carbonates of alkaline-earth metals as basic sources for correcting the carbonate content in natural waters and sewage under natural conditions and during water treatment and water preparation plants was described and discussed. The study showed that there are adequate resources for carrying out carbonization in all cases required, including the technology of purifying and preparing natural waters and sewage. Technologically, the most suitable reagent for carbonization of waters is soda ash but it is expensive in the USSR. There must be a standard for carbonate loading of filters which regulate its chemical and granulometric composition, mechanical strength and which contain physiological and hygienic and toxicological requirements for the amount of permissible admixtures in it. Greater use of air as a cheap and available source of carbon dioxide was recommended. Figures 4; references 35: 23 Russian; 12 Western.

**Electrochemical Treatment of Chlorate-Containing Sewage**

917M0115F Kiev *KHIMIYA I TEKHOLOGIYA*  
*VODY in Russian Vol 13, No 2, February 1991*  
pp 166-168

[Article by S. B. Kamenev, S. V. Preys and E. K. Siyrde;  
Tallin Technical Institute]

UDC 628.3

[Abstract] A study of the process of electrochemical removal of chlorate ions from water conducted on both model solutions of potassium chlorate and on actual sewage from match production involved the use of a laboratory electrolyzer and an experimental device under plant conditions. Electrolysis was performed both periodically and continuously in an electrolytic bath with the use of laminated soluble steel electrodes. Study of match production sewage containing about 4 kg/m<sup>3</sup> of chlorate ions showed the dependence of the reduction of potassium chlorate concentration on the specific energy expenditure. Data concerning the qualitative and quantitative composition of sediment forming during electrocoagulation were obtained. Use of the method provided effective removal of chlorate-ions from sewage by reducing the latter in the near-cathode space and ensured the required degree of removal of chlorate ions according to other indicators. Figures 2; references 6 (Russian).

**Removing Ammonium Nitrite From Sewage by Thermal Method**

917M0115G Kiev *KHIMIYA I TEKHOLOGIYA*  
*VODY in Russian Vol 13, No 2, February 1991*  
pp 172-174

[Article by L. I. Olefir, B. N. Shukaylo, and B. P. Zhantaly; State Scientific Research Institute Methanol Project, Severodonetsk, Lugansk Oblast]

UDC 628.33

[Abstract] Determination of conditions of thermal decomposition of ammonium nitrite in sewage involved a study, in an autoclave at 130-230°, 490-2942 kPa, pH 4-10 and concentration of NH<sub>4</sub>NO<sub>2</sub> in water from 100 mg/l to 10 g/l. Decomposition of ammonium nitrite increased with the increase of temperature from 130-230°. At 130° and pH 3.89 the water must be treated for 40 minutes for decomposition of ammonium nitrite by 98.8 percent, while it was decomposed by only 82.9 percent after 300 minutes at pH 8.48. A temperature no lower than 230°C was required to reduce the time of decomposition of ammonium nitrite in order to use this method under industrial conditions. The level of ammonium nitrite in sewage decreased to 1 mg/l after 20 minutes under these conditions. Isolation of nitrogen and ammonium oxides in the gaseous phase was excluded. Under the present stressed ecological setting, use of worthless heat energy was recommended for

removing ammonium nitrite from sewage. The optimal values of pH in the process were 4-7. References 8 (Russian).

**Introduction of Electrochemical Method of Water Conditioning in Closed Water Supply System of Swimming-pool**

917M0115H Kiev *KHIMIYA I TEKHOLOGIYA*  
*VODY in Russian Vol 13, No 2, February 1991*  
pp 174-177

[Article by V. V. Maksimov and A. V. Slipchenko; Institute for Advanced Training of Supervisory Workers and Specialists of MZhKKh; UkSSR; Kiev]

UDC 541.135.2+628.1.032+628.337

[Abstract] An experimental-industrial test of the "Magnetit-3" and "Magnetit-4" devices with magnetite-titanium anodes for conditioning water was tested at the swimming pool "Prometey" in Boyarka. The existing flow chart of water treatment of the pool was reconstructed by installation of a chlorate device. The reconstruction and introduction of an electrolyzer has resulted in significant savings of potable water and ensured high quality of the swimming pool water. Use of a combined method of chlorination and ammonization has reduced operation costs of the pool and increased the safe life of the electrolyzers. Figures 2; references 4 (Russian).

**Sewage Treatment by Use of Hydrogen Peroxide Electrosynthesis**

917M0115I Kiev *KHIMIYA I TEKHOLOGIYA*  
*VODY in Russian Vol 13, No 2, February 1991*  
pp 177-179

[Article by A. V. Selyukov, V. S. Bagotskiy, A. I. Trinko and P. F. Kandzas; All Union Scientific Research Institute; All-Union Scientific Research Institute of Water Supply, Channelization, Hydrotechnical Installations and Engineering Hydrogeology; Institute of Electrochemistry imeni A. N. Frumkin; USSR Academy of Sciences; Moscow]

UDC 628.34:546.215:514.138.3

[Abstract] Studies of sewage treatment with the use of hydrogen peroxide synthesized by an electrochemical method included laboratory studies and bench tests of the electrosynthesis process. The 1st stage of tests involved lengthy experiments to determine the electrolyzer productivity for hydrogen peroxide and calculated the energy required to produce 1 g of oxidizing agent. At optimal current density (200 A/m<sup>2</sup>) these values were 2.2 g/hr and 40.8 Wxhr/g. A technique for removing hydrogen sulfide employed an oxidizing agent with concentration of 1.50-1.55 g/l and a quantity of 10 percent of the water expenditure. With reaction time of 20 minutes and 160 hours of operation of the device, the residual hydrogen sulfide did not exceed 1.0 mg/l. Flow

charts (illustrated in the article) were proposed for removing hydrogen sulfide and cyanides from sewage, by using hydrogen peroxide, synthesized electrochemically. With productivity of the devices of 5 m<sup>3</sup>/hr (80 m<sup>3</sup>/day, the economic impact from use of the procedure is 33,000 and 60,000 rubles annually for hydrogen sulfide and cyanides, respectively. Solvents produced, with hydrogen peroxide concentration up to 20 g/l proved to be especially suitable for removing the impurities. Figure 1; references 7 (Russian).

#### **Removing Organic Admixtures and Suspended Substances From Drilling Waste Waters**

917M0115J Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian* Vol 13, No 2, February 1991 pp 179-183

[Article by B. G. Varfolomeyev, V. L. Pebalk and V. I. Litvinenko; Moscow Institute of Precision Chemical Technology imeni M. V. Lomonosov]

UDC 622.245.82:628.345

[Abstract] A study of the effectiveness of treating drilling waste waters, at the Komineft association, by a coagulation method used aluminum sulfate as the most effective coagulant. Empirical dependences for calculating the effectiveness of removal of organic admixtures and suspended substances as a function of the coagulant dose and the initial degree of contamination of the waste waters were obtained. A study of the settling of the coagulated drilling waste waters in a sloping shelf settling tank determined the technological characteristics of the process under dynamic and static conditions and provided a calculated equation for the period of forming distribution of the solid phase along the length of the settling tank. Experimental adsorption isotherms determined the choice of an adsorbent for final purification of the waste waters. The adsorbent is activated charcoal AG-3. Results of tests of an industrial adsorber were presented. Figures 5; references 7 (Russian).

#### **Sorbents Based on Natural Disperse Minerals To Extract Nonionogenic Surfactants**

917M0136A Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian* Vol 13 No 5, May 91 (manuscript received 14 Sep 90) pp 412-415

[Article by A.A. Panasevich, G.N. Klimova, and Yu.I. Tarasevich, Institute of Colloidal Chemistry and Water Chemistry imeni A.V. Dumanskiy, UkSSR Academy of Sciences, Kiev]

UDC 541.183:628.515

[Abstract] Agrillaceous minerals are known to be highly absorbent with respect to nonionogenic surfactants. When used as modifiers they make it possible to significantly increased the efficiency of extracting nonionogenic surfactants from aqueous solutions. In view of

these facts, the authors of the study reported herein conducted a series of experiences to determine those conditions that would make it possible to graft the maximum amount of ions capable of complex formation on the surface of disperse minerals and to determine the optimal amount of these ions associating nonionogenic molecules in solution and thereby facilitating an increase in their adsorbability. Glukhovetsk kaolinite, Circassian hydromica, montmorillonite, and palygorskite were treated with iron chloride and nitrates. The adsorption properties of the thus modified sorbents were studied in relation to oxyethylated isooctylphenol of the general formula C<sub>8</sub>PhE<sub>7</sub>. Adsorption of the C<sub>8</sub>PhE<sub>7</sub> from aqueous solutions was conducted under static conditions at a disperse phase concentration of 1% (by weight). The adsorbent was kept in contact with the solution for 24 hour, after which time adsorption equilibrium was achieved. Grafting Fe<sup>3+</sup> in amounts up to 2.5 to 3 exchange capacities was found to increase the adsorbability of the minerals studied significantly. Further increasing the concentration of iron ions did not appear to result in any significant changes in adsorption. Increasing the acidity of the medium, especially in the case of pH levels of <3.5, caused a sharp increase in adsorption of nonionogenic surfactants in all of the aforementioned minerals studied. An Fe(III):C<sub>8</sub>PhE<sub>7</sub> ratio of 1:3 was determined to be optimal when preparing a solution for adsorption on an Fe form of mineral. The authors thus concluded that sorbent suitable for treating sewage over a wide range of pH levels could be prepared on the basis of natural highly dispersed agrillaceous minerals and transition metal ions. They further determined that preliminary implantation of a complex-forming cation into the adsorbate can increased the adsorbability of agrillaceous minerals modified with iron cations by a factor of about 1.5. Figures 4, table 1; references 12: 11 Russian, 1 Western.

#### **Equilibrium Adsorption of Selected Benzene Derivatives and Nonionogenic Surfactants on Different Types of Glycidylmethacrylate Sorbents**

917M0136B Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian* Vol 13 No 5, May 91 (manuscript received 12 Nov 90) pp 415-419

[Article by V.V. Podlesnyuk, I. Gradil (Czech and Slovak Federal Republic), N.A. Klimenko, F. Shvet (Czech and Slovak Federal Republic), and L.Ye. Fridman, Institute of Colloidal Chemistry and Water Chemistry imeni A.V. Dumanskiy, UkSSR Academy of Science, Kiev]

UDC 541.183.5

[Abstract] Synthetic polymer sorbents are beginning to enjoy intensive use in the extraction of different classes of organic matter from aqueous solutions. In an effort to supplement previous research on these sorbents, the authors of the study reported herein examined modified



sorbent based on glycidylmethacrylate and ethylenedimethacrylate in order to determine their adsorption properties in relation to benzene derivatives and nonionogenic surfactants. The modified sorbents studied were obtained by two methods: 1) acid hydrolysis of the starting specimens in a 1 M solution of sulfuric acid for 24 hours followed by rinsing in water and drying and 2) treatment of the starting specimens with a secondary solvent (dioxane) for 48 hours followed by treatment with ethyl alcohol and ether and vacuum drying at a temperature below the vitrification point. Three sorbents were produced by the first method, and one was produced by the second. Three benzene derivatives (n-chloroaniline, phenol, and aniline) and three nonionogenic surfactants (Triton X-100, Triton X-305, and Triton X-405) were used as sorbates. A comparison of the adsorption properties of modified and nonmodified methacrylate sorbents established the fact that adsorbability is increased on the dioxane-treated sorbents and reduced on the hydrolyzed sorbents. Hydrophilization of the surface of methacrylate sorbents owing to hydrolysis had little effect on their adsorption properties with respect to n-chloroaniline. Surface polarization was found to exert an effect in the case of adsorption on sorbents possessing weakly acidic (phenol) and weakly basic (aniline) properties. The authors were able to conclude that, overall, adsorbents based on glycidylmethacrylate and ethylenedimethacrylate can be used to effectively extract all substances possessing acid properties from aqueous solutions. Findings related to the three different Triton X sorbents used are also discussed. Figures, 6 tables 2; references 14: 10 Russian, 4 Western.

#### **Determining the Main Thermophysical Properties of Mineralized Waters Subject to Desalinization**

917M0136C Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 13 No 5, May 91 (manuscript received 29 Oct 90) pp 419-421*

[Article by V.I. Maksin and Ye.V. Skorobogach, Institute of Colloidal Chemistry and Water Chemistry imeni A.V. Dumanskiy, UkSSR Academy of Science, Kiev]

UDC 663.635:66.012.1:532.14

[Abstract] Making the basic calculations entailed in designing processes of demineralizing, concentrating, and processing mineralized waters and brines requires knowledge of the principal thermophysical properties of solutions at different salt concentrations, temperatures, and pressure. Specifically, process engineers must have knowledge of the following: density, viscosity, heat capacity, heat conduction, and boiling point. For binary solutions of most salts, these characteristics are easily determined by interpolation of tables available in reference manuals and monographs. Reference data are not so readily available for multicomponent solutions, however. In an attempt to fill in this knowledge gap, the authors of this article present a series of equations that make it possible to determine the main thermophysical

properties of chloride-sulfate mineralized waters and brines by using a simple algorithm and without having a large amount of reference data. Specifically, the authors demonstrate that viscosity, heat capacity, and heat conduction depend on the density of the given solution. Coefficients for seven different components of brine that can be used when using the expressions presented to calculate the density of solutions are given in table form. Table 1; references 5 (Russian).

#### **Sorption-Photometric Determination of Microquantities of Cobalt in Water**

917M0136D Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 13 No 5, May 91 (manuscript received 24 Dec 90) pp 425-427*

[Article by L.I. Savranskiy and O.Yu. Nadzhafova, State University imeni T.G. Shevchenko, Kiev]

UDC 543.31:543.4:543.544:546.733

[Abstract] In an effort to improve the available methods for monitoring microquantities of cobalt in water, the authors of the study reported herein examined a sorption-photometric technique. The proposed method calls for sorption separation of cobalt from aqueous solutions. Next, the cobalt is determined in the form of a chelate with (1-2-pyridylazo)-2-naphthol by measuring the spectra of its diffuse reflection. This is done without desorption of the cobalt from the sorbent's surface. After varying several aspects of the procedure, including the sorbent used, the authors recommended that their new sorption-photometric technique be used after the cobalt to be determined has been concentrated on the nonmodified sorbent silica gel L 40/100 in the form of a chelate with (1-2-pyridylazo)-2-naphthol, followed by measurement of its diffuse reflection at 620 nm. The sorption was conducted in a static mode from 100- and 300-ml aqueous solutions in a 0.2-g weighted portion of silica gel. Under conditions of an initial pH of 5-6 and (1-2-pyridylazo)-2-naphthol concentration of  $2 \times 10^{-5}$  M, linearity of sorption was observed when the cobalt concentrations in the sample ranged from 2 to 10  $\mu\text{g}$ . Selectivity of the reaction was ensured by subsequent acidification of the solution with hydrochloric acid to a 0.5 M concentration. The method was found to be simple to use, and the results it produced were found to have a good reproducibility. The new sorption-photometric method was tested on model solutions and samples of drinking and mineral water by the additive method. Figure 1, tables 2; references 12: 11 Russian, 1 Western.

#### **The Reverse-Osmosis Properties of Dynamic Membranes Made of Silica Compounds**

917M0136E Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 13 No 5, May 91 (manuscript received 13 Jul 89; after revision 26 Dec 90) pp 436-440*

[Article by D.D. Kucheruk, Institute of Colloidal Chemistry and Water Chemistry imeni A.V. Dumanskiy, UkSSR Academy of Science, Kiev]



UDC 682.165.532.71

[Abstract] The semipermeable polymer membranes (specifically, acetylcellulose, polyamide, etc.) that are widely used in reverse-osmosis water treatment technologies are plagued by two major shortcomings: They are subject to hydrolysis and shrinkage under the effect of pressure and temperature. In a continuation of recent research on semipermeable dynamic membranes made of inorganic compounds, the authors of the study reported herein examined the feasibility of making dynamic membranes from colloidal particles of selected heavy metal silicates. Specifically, they examined the reverse-osmosis properties of dynamic membrane made from colloidal particles of aluminum, chromium, and copper silicates. The reverse-osmosis properties of the membranes examined were found to depend on the pH of the forming solution and on the pressure, composition, and concentration of the solution to be demineralized. The comparative experiments conducted indicated that dynamic membranes made of aluminum silicate sols are most effective. They have high reverse-osmosis properties and may thus be recommended for use in desalinating chloride solutions by the reverse-osmosis method at a pH of 4.4 to 4.5 and a pressure of 2 to 3 MPa. Figures 6; references 11: 9 Russian, 2 Western.

#### Using Sorbents To Clean Wastewaters From Printing Processes at Textile Factories

917M0136F Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 13 No 5, May 91 (manuscript received 12 Jun 90) pp 440-442

[Article by L.A. Stetsenko, V.S. Rak, and Yu.I. Tarasevich, Kharkov State University and Institute of Colloidal Chemistry and Water Chemistry imeni A.V. Dumanskiy, UkSSR Academy of Science, Kiev]

UDC 541.183.2:543.142:628

[Abstract] The printing shops at textile plants generate wastewater containing high concentrations of dyes. In view of the toxicity of the chemicals contained in these wastewaters and the importance of adequate treatment of these wastewaters, the authors of the study reported herein compared the effectiveness of using different sorbents to clean the wastewaters generated by prints: 1) natural montmorillonite from the Oglanly deposit in the TSSR, a 2) semisynthetic adsorbent based on Oglanly montmorillonite by modifying it with aluminum polyoxochlorides, 3) a carbon produced by destructive distillation of conditioned activated sludge (representing a mineral-charcoal sorbent produced by pyrolysis of the sediment from the cleaning equipment at a paper-and-pulp combine), 4) the charcoal sorbent KAD, and 5) the charcoal sorbent AG-3. The tests conducted indicated that the carbon obtained from the conditioned activated sludge (sorbent 3) was most effective in reducing the dye content of the wastewaters tested; using this sorbent resulted in a reduction of the dye concentration by a factor of 5 to 10. Ranked from most to least

effective as an agent reducing dye concentrations, the sorbents may be listed as follows: carbon produced from conditioned activated sludge, AG-3 charcoal sorbent, KAD charcoal sorbent, semisynthetic montmorillonite, and natural montmorillonite. The activated sludge-based carbon sorbent is further recommended because it is not only feasible to produce but also inexpensive. Table 1; references 8 (Russian).

#### Conditioning Wastewater Sediments With Cationic Flocculants

917M0136G Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 13 No 5, May 91 (manuscript received 6 Dec 90) pp 445-447

[Article by V.A. Slipchenko, V.M. Udod, and G.M. Kotlyar, IPK [not further identified], UkSSR State Committee for Housing and Municipal Services, Kiev]

UDC 628.16:628.3

[Abstract] Despite the numerous scientific literature devoted to treating wastewater sediments, little information exists on the use of cationic flocculants in the treatment of such sediments. In view of this lack of information, the authors of the study reported herein designed a study intended to gather the information needed to develop a technology for using cationic flocculants to condition wastewater sediments. In a research project that was conducted at the Bortnichskaya Aeration Station in Kiev, the researchers examined the following aspects of the problem: the effect of type and dose of flocculant on the effectiveness of neutralizing sediment; the effect of type of sediment on the selection of flocculant type and dose; the effect of various physicochemical conditions on the sediment neutralization process; and the effect of sediment transport time on the sediment's specific resistance. The following flocculants were tested: VPK-101, VPK-402, VPK-500, VPK-600, VPK-700, VPK-900, K-100, PPS, K-120-85, K-100-40, and PAA. The flocculants were tested from the standpoint of their effectiveness in treating anaerobic-fermented sediment, i.e., a mixture of fresh sediment and compacted excess activated sludge in a 1:6 ratio. Both bed and full-scale test were conducted. The flocculants' activity was discovered to be linked with their molecular mass: The higher the relative molecular mass, the higher the flocculant's efficiency. The most effective flocculants were VPK-402, K-100, and PPS. VPK-402 was most effective in treating sediment with a pH between 6 and 8 and at a temperature of 30 to 40°C. The VPK-402 was found to intensify the dewatering process significantly. After 9 days the moisture of the sediment to which VPK-402 had been added fell from 97.3 to 87%, and the volume of sediment decreased from 64,000 to 17,000 m<sup>3</sup> (i.e., by a factor of 4). These results were far better than those achieved by the conventional technique, i.e., a moisture reduction to 75% after 3 to 4 weeks. It was estimated that using VPK-402 cationic flocculant at an aeration station with a capacity of

100,000 m<sup>3</sup>/d could result in a yearly savings on the order of 80,000 rubles. Figures 6, table 1; references 9 (Russian).

**The Effect of Chalk Primer on Operating Mode of Evaporators at Thermal Desalination Plants**

917M0136H Kiev *KHIMIYA I TEKHOLOGIYA*  
*VODY in Russian Vol 13 No 5, May 91 (manuscript*  
*received 17 Dec 90) pp 447-450*

[Article by Yu.S. Baranov, I.G. Vakhnin, and P.K. Lebedev, Institute of Colloidal Chemistry and Water Chemistry imeni A.V. Dumanskiy, UkSSR Academy of Science, Kiev]

UDC 628.165

[Abstract] The 12 thermal desalination units at the distillate plant of the Mangyshlak Power Combine is the main source of household and drinking water to the city of Shevchenko, which has a population of about 200,000. Together, the 12 thermal desalination units produce more than 140,000 cubic meters of distillate daily. Each of the desalination units has an identical design and consists of a heating chamber, separator, and circulation pump. Before each of the units was put into service, a chalk primer was included in the heat exchange pipes to prevent scaling. This chalk primer has made it possible for the desalination units to operate for 6 to 8 months without accumulating a calcium carbonate layer exceeding 0.1 to 0.15 mm in thickness. The desalination units have not operated without problems, however. They have been observed to undergo a drop in operating efficiency in the period between their scheduled repairs. The authors of this article examine four possible causes for this drop in operating efficiency: 1) the failure of the evaporators' circulation pumps, 2) the precipitation of scale on the surfaces of the evaporators' heat exchange tubes, 3) the formation of chalk plugs in the heat exchange tubes that cause the brine to stop circulating through the tubes, and 4) drift of the chalk primer into the separators' jalousie demisters. After analyzing each of these factors individually, the authors conclude that the drop in the thermal desalination units' productivity in between repair periods is due primarily to the formation of chalk plug in the evaporators' heating tubes and to the drift of the chalk primer into the jalousie demisters. Studies conducted at the distillate plant indicated that flushing the tubes with acid every 1.5 to 2 months

without shutting down the thermal desalination units is sufficient to remedy this problem, even with a between-repair period of 10 to 12 months. It was further decided that because removing the jalousie demisters would not adversely affect the quality of the distillate produced by the desalination units, they could and would be dismantled. There are no plans to install new demisters. Figures 3.

**Using Copper Ions in Water Treatment**

917M0136I Kiev *KHIMIYA I TEKHOLOGIYA*  
*VODY in Russian Vol 13 No 5, May 91 (manuscript*  
*received 12 Nov 90) pp 471-473*

[Article by O.S. Savluk, I.P. Tomashevskaya, and V.N. Kosinova, Institute of Colloidal Chemistry and Water Chemistry imeni A.V. Dumanskiy, UkSSR Academy of Science, Kiev]

UDC 628.322:661.433

[Abstract] Because of the deterioration in natural water quality that has occurred over the past few years, conventional water treatment methods such as chlorination have proved to have a number of limitations. One prospective method of treating water that does not appear to entail the formation of cancer-causing by-products is that of using copper ions in the electrolytic treatment of water in special units called copper ionizers. The authors of the study reported herein created a prototype copper ionizer and conducted a set of experiments to determine the values of various process parameters including optimal current density, voltage, and power consumption and water treatment mode. The experiments indicated that the a suitable current density would be one ranging from 5 to 20 mA/cm<sup>2</sup>, that the water should move through the space between the electrodes at a speed of at least 0.2 m/s, that the electrodes should be 6 to 7 apart, and that the voltage in the ionizer should be between 6 and 14 V. The prototype ionizer was demonstrated to operate reliably and stably for a 6-month period. Reducing the pH to 7 or below was found to intensify the process significantly. The presence of SO<sub>4</sub><sup>2-</sup> was also found to activate the process. Carbonate ions were found to exert a marked passivating effect on the process. The proposed copper ionizer and process were thus recommended for the copper treatment of sulfate and chloride classes of water but not recommended for treating water of the carbonate class. Figures 4; references 12: 11 Russian, 1 Western.

**Polarographic Behavior of Suspensions of Elemental Tellurium and Mercury Telluride**

917M0138B Ivanovo IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA TEKHOLOGIYA in Russian Vol 34 No 1, Jan 91 (manuscript received 17 Jan 90) pp 79-81

[Article by S. V. Kovaleva and V. P. Gladyshev, Chair of Inorganic Chemistry, Melitopol State Pedagogical Institute]

UDC 541.138

[Abstract] Alternating current polarographic studies were conducted on elemental tellurium and mercury telluride in 1 M NaOH and 0.5 M  $H_2SO_4$  to ascertain the nature of processes responsible for ca. -1.2 V maxima on conventional polarograms. Analysis of the peak potentials obtained with alternating current polarography for both samples in acid and alkaline media indicated that the maximum correspond to reduction of tellurium (IV). Accordingly, in the case of mercury telluride the maximum peak may be assumed to represent reduction to hydrogen telluride ( $H_2Te$ ) in sulfuric acid and to telluride ions in sodium hydroxide. Figures 3; references 6: 4 Russian, 2 Western.

**Effects of Implanted Ions on Electrochemical Behavior of Binary Ni:Cr Alloys**

917M0138C Ivanovo IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA TEKHOLOGIYA in Russian Vol 34 No 1, Jan 91 (manuscript received 30 Jan 90) pp 82-85

[Article by N. A. Amirkhanova, R. Kh. Nuriyeva, D. A. Baytalov and O. A. Dmitriyeva, Chair of General Chemistry, Ufa Aviation Institute]

UDC 621.793.324

[Abstract] An analysis was conducted on corrosion resistance of binary Ni:Cr  $\gamma$ , ( $\gamma+\beta$ ) and  $\beta$  alloys bombarded with 40 keV nitrogen or boron ions ( $15-20 \mu A/cm^2$ ;  $10E17$  ions/cm<sup>2</sup>). Determinations of surface potentials and polarization plots demonstrated that doping with nitrogen ions was protective for  $\gamma$ -alloys with < 30% Cr against corrosion by 5% NaCl, whereas doping the surface with boron was not. The difference was attributed to greater electronegativity differences of metal-nitrogen pairs (1.32-1.51) than of metal-boron pairs (0.26-0.45). As the concentration of Cr increased the efficacy of nitrogen atoms diminished. In the case of  $\beta$  and ( $\gamma+\beta$ ) alloys this was attributed for formation of surface chromium oxide films since the electronegativity difference for metal-oxygen pairs (1.7-1.9) exceeded that of metal-nitrogen pairs. Figures 3; references 6 (Russian).

**Physical Properties of Lithium Ferrite Produced by Low-Shrinkage Technology**

917M0138D Ivanovo IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA TEKHOLOGIYA in Russian Vol 34 No 1, Jan 91 (manuscript received 19 Mar 90) pp 86-89

[Article by M. P. Bogdanovich, Chair of Physics, Vitebsk Pedagogical Institute imeni S. M. Kirov]

UDC 537.311:538.245:548.3

[Abstract] An analysis was conducted on charged mixture as a factor in the production of lithium ferrite by low-shrinkage technology, and the physical properties of the product. The results showed that a charge yielding  $Li_{0.4+x}Fe_{2.6-x}O_4$ , where  $x = 0-0.2$ , heated at a rate of  $1000^\circ C/h$  to  $1150^\circ C$  for 2 h represented optimum conditions of synthesis. The resultant ferrite displayed a crystalline lattice with  $a_1 = 0.8330$  nm,  $a_2 = 0.8394$  nm and  $a_3 = 0.8319$  nm, a hysteresis loop with  $\alpha > 0.90$ , a coercive force of  $N = 470$  A/m, and electrical resistance of  $\rho = 10E6$  ohm x m. Figures 2; references 5 (Russian).

**Theoretical Aspects of Producing and Using Carbon Fiber Adsorbents**

917M0061A Mytishchi *KHIMICHESKIYE VOLOKNA*  
in Russian No 6, Nov-Dec 90 pp 10-13

[Article by L. I. Fridman, S. F. Grebennikov]

UDC 677.529.661.183

[Abstract] Carbon-fiber adsorbents with 6- to 12- $\mu$ m-diameter elementary fibers, variable and homogeneous micropore structures, and reactive chemical groups on the surface have superior rates of sorption and desorption with no toxic, irritant, or allergenic properties. The theoretical and practical requirements behind the concept of selecting initial polymer fibers and the carbon fibers they produce for subsequent activation are discussed. The change in the structure of the carbon fiber during activation is described. Equations are derived for the rate of activation as a function of the degree of activation based on the formal kinetics of the topochemical reactions. The sorption properties of carbon fiber adsorbents are studied under static and dynamic conditions. Areas of application of carbon-fiber sorbents that have been suggested, tested, and partially introduced to practice include recovery of volatile sorbents, purification of ventilation exhaust to remove low concentrations of toxic substances, purification of working gases in cryogenic systems, purification of waste water and special solutions to remove organic substances, purification of air and water in small enclosed spaces, removal of small concentrations of the salts of expensive heavy and other rare metals, sorption and biological purification of water under field conditions, creation of absorbing specialized clothing, and creation of collective and individual means of protection of the organs of respiration and the skin. References 8: Russian.

**Polymer Composite Materials Reinforced With Aramid Fabric**

917M0061B Mytishchi *KHIMICHESKIYE VOLOKNA*  
in Russian No 6, Nov-Dec 90 pp 14-16

[Article by N.M. Grad, V.N. Pershikov, L.N. Lupinovich, G.P. Budanova, I.B. Lishnevskaya, A.A. Andreyev, and R.I. Sedinkina]

UDC 667.675:678.586

[Abstract] Results are described from a study performed in order to produce nonflammable polymer composite materials that retain good physical and mechanical characteristics at usage temperatures of up to 470 K. These materials are less expensive than the thin-sheet organotextolite presently industrially produced. OTA-S unidirectional reinforcing fabric is described with a warp of synthetic fiber cord and a woof of complex synthetic fiber thread. The use of the cord instead of the thread in

the warp improves the physical and mechanical properties of the organic reinforced textolite and the productivity of labor while decreasing cost. Figures 2; References 4: Russian.

**Properties and Use of Low- and Medium-Modulus Carbon Fibers**

917M0061C Mytishchi *KHIMICHESKIYE VOLOKNA*  
in Russian No 6, Nov-Dec 90 pp 16-18

[Article by R. M. Levit]

UDC 677.529.014/017+677.529.004.14

[Abstract] Data on the properties of carbon fibers, particularly the low- and medium-modulus carbon fibers that are comparatively widely used today, are presented. These data have been gleaned primarily from Western cooperations such as Union Carbide. A graphic illustrates areas of application of these fibers, including heating elements, antistatic materials, electronic materials, electrodes, insulation, fillers for plastics and concrete, chemically stable structural materials, sorbents and catalysts, sealers and packing materials, filtering materials, friction-modifying materials, and electricity-conducting materials. The Khimvolokno Scientific Research Institute in Leningrad has developed an assortment of soft and medium-modulus carbon fibers based on ordinary viscos and PAN fibers that are now in industrial production as cords and fiber segments 5-60 mm in length. The savings resulting from the introduction of these materials has exceeded 14 million rubles. Figures 3; References 11: 10 Russian, 1 Western.

**The Use of an Air Jet To Cool Filaments Formed From a Polymer Melt**

917M0061D Mytishchi *KHIMICHESKIYE VOLOKNA*  
in Russian No 6, Nov-Dec 90 pp 26-29

[Article by I.D. Pupyshev and I.A. Zarubin]

UDC 677.494.021.125.56

[Abstract] An air jet generator has been developed and tested to determine the effects of air jets on polymer filaments. Tests showed that a thin jet of air can be used to perform a number of practical tasks related to improvement of the design of spinning machines, as well as optimization, testing, and control of the process of forming filaments from polymer melts. The jet thickness need not be over 0.1 mm and should be directed across the filament as it is formed. The air jet eliminates the need for circulating cooling water in the spinning machine and can be used to monitor and control a number of parameters of the process including cooling, winding tension, and the position of areas of phase change in the filament. Proper exhausting of the air jet also reduces internal pollution. Figure 1; References 16: Russian.

**The Hydrodynamics of a Cellulose Envelope  
Formed by the Sleeve Method**

917M0061E Mytishchi *KHIMICHESKIYE VOLOKNA*  
in Russian No 6, Nov-Dec 90 pp 29-31

[Article by V.M. Irkley, O.S. Vavrinyuk, K.Ya. and  
Reznik, V.I. Pirogov]

UDC 677.463-416.021.125.261:532.5

[Abstract] A study is made of the hydrodynamics of the processes forming cellulose sleeves, and equations are suggested to compute the rate of movement of settling baths and the proper flow rate to ensure low hydraulic resistance. Figure 1; References 6: Russian.

**Biologically Active Collagen Fibers and Fiber  
Materials**

917M0061F Mytishchi *KHIMICHESKIYE VOLOKNA*  
in Russian No 6, Nov-Dec 90 pp 39-41

[Article by M.P. Vasilev and L.A. Volf]

UDC 677.472.6

[Abstract] In order to produce collagen suitable for the formation of fibers by methods used in the chemical fiber industry, the authors modified the alkaline and alkali-salt methods and developed a cryochemical method of preparing collagen for dissolution. Spinning compositions for the production of collagen monofilaments were obtained by an acid-base method involving mild processing of collagen by a suspension of calcium hydroxide with subsequent exposure to hydrochloric acid. This process largely preserves the native collagen structure and forms concentrated compositions with viscosity anomalies that are suitable for spinning and extrusion to form fibers and filaments with satisfactory mechanical properties. Figures 5; References 14: 11 Russian, 3 Western.

**Determination of Residual Organic Solvent  
Content in Biocatalyst Fibers by Vapor-Phase Gas  
Chromatography**

917M0061G Mytishchi *KHIMICHESKIYE VOLOKNA*  
in Russian No 6, Nov-Dec 90 pp 55-56

[Article by L.N. Matveyeva, N.A. Tarasova, T.I. Ivanova, T.V. Fadyushina, A.P. Kholodova, and Z.G. Solomon]

UDC 543.544:544.812

[Abstract] A gas-chromatographic method has been developed to determine the content of residual organic solvents in biocatalyst fibers containing  $\beta$ -galactosidase formed in tetrachloroethylene by vapor-phase gas-chromatographic analysis based on the principle of concentration of low-boiling-point substances in the vapor-air phase over a specimen in a sealed vessel, sampling of

the vapor-air phase, and chromatography of the sample. The method was tested on a number of batches of biocatalyst fiber and has successfully completed metrologic certification. Figures 3; References 3: Russian.

**The Production and Selected Properties of  
Microporous Membranes Made of Aluminum  
Oxide**

917M0137A Kiev *UKRAINSKIY KHIMICHESKIY  
ZHURNAL* in Russian Vol 57 No 5, May 91  
(manuscript received 19 Apr 90) pp 474-480

[Article by A.P. Savitskiy, M.T. Bryk, and V.N. Pavlikov, Institute of Colloidal Chemistry and the Chemistry of Water, UkSSR Academy of Sciences, Kiev]

UDC 666.3-127

[Abstract] In recent years scientists and technologists have devoted a great deal of effort to creating inorganic (including ceramic) membranes. Their high stability in corrosive media and high temperatures, capability of repeated regeneration, biological and chemical inertness, and long operating life (5 to 10 years or more) make them a promising alternative to polymer membranes. Because methods of manufacturing them have not yet been adequately developed, the authors of the study reported herein examined the physicochemical characteristics of aluminum oxide-based microfiltration membranes with a view toward developing a method of producing them. They manufactured corundum disks (diameter, 25 mm; thickness, 3 mm) by using the semidry method to press disperse  $\alpha$ - $\text{Al}_2\text{O}_3$  under a specific pressure of 250 to 500 kg/cm<sup>2</sup> following by solid-phase sintering. They then determined the specimens' key structural parameters (ultimate compression strength, open porosity, pore diameter, and specific water permeability) and used them to derive a Poiseuille formula expressing the link between them. In the next stage of their project, the researchers proceeded to develop an optimal scheme for producing aluminum oxide-based membranes. They discovered that adding between 4 and 9% (by weight) binder makes it possible to produce membranes at an annealing temperature of about 1,230°C that have structural parameters analogous to those of ceramic made of pure alumina (without binder) at annealing temperatures of 1,450 to 1,500°C. They further concluded that using organic additives increases a dispersion's resistance to stratification and that the creation of composite ceramic membranes with thin ultrafiltration layers hinges on the use of high-quality microfilters with a rather narrow pore size distribution (with an average hydraulic radius of no more than 0.2 to 0.3  $\mu\text{m}$ ). The two-layer ceramic membranes produced by the researchers were successfully tested in an FM-01 ultrafiltration cell. Figures 2, tables 5; references 9: 5 Russian, 4 Western.

### Effects of Diffusion Zones on Magnetic Parameters of Hysteresis Loop of Heterogeneous Ferrites

917M0138E Ivanovo IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA TEKHOLOGIYA in Russian Vol 34 No 1, Jan 91 (manuscript received 19 Mar 90) pp 121-123

[Article by M. P. Bogdanovich, Chair of Physics, Vitebsk State Pedagogical Institute imeni S. M. Kirov]

UDC 538.21

[Abstract] An analysis was conducted on residual and maximum magnetic induction of hysteresis loop, their ratio ( $\alpha$ ), coercive force of the hysteresis loop, and relative mass loss in relation to sintering duration at 1150°C of  $Mg_{0.7}Cu_{0.3}Fe_2O_4$  (I),  $Li_{0.45}Ni_{0.1}Fe_{2.45}O_4$  (II) and their 1:1 mixture (III). Graphical and tabular depiction of the results showed a relatively smooth exponential increase in the residual and maximum magnetic induction of I and II, but a more complicated curve in the case of III marked by a series of plateaus. The latter evidently reflected the impact of stress in the diffusion zone between the 2 phases on magnetic induction. Plots of  $\alpha$  vs. time revealed a plateau after ca. 80 min in all 3 cases. The temporal plots also demonstrated a reduction in coercive force and weight with time. In the case of sample I weight reduction was attributed to loss of oxygen, in II to loss lithium and in III to loss of both oxygen and lithium. Figures 3; tables 2; references 2 (Russian).

### The Role of Potassium Chloride in the Process of the Thermal Breakdown of BSSR Oil Shale

917M0140C Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA KHIMICHESKIKH NAUK in Russian No 2, Mar-Apr 91 (manuscript received 23 Oct 90) pp 91-95

[Article by I.I. Lishtvan, G.I. Morzak, P.L. Falyushin, and Ye.A. Yurkevich, Institute of the Problems of Using Natural Resources and Ecology, BSSR Academy of Sciences]

UDC 662.74:662.67

[Abstract] The authors of the study reported herein have conducted a detailed examination of the role of potassium chloride in the different stages of the process of the thermal breakdown of oil shales from the Turov deposit in the BSSR. Powder shale was impregnated with a potassium chloride solution (1% as calculated with respect to dry substance) and dried to an air-dry state. The effectiveness of the activity of the implanted chloride on the thermal breakdown process was determined on an OD-103 derivative thermogravimetric analyzer in a covered platinum crucible. A weighted portion of about 500 mg was heated from 20 to 1,000°C at a rate of

10°/min. Both starting shale and KCl-impregnated shale were subjected to staged thermolysis in a quartz retort placed in a tubular electric furnace. The reaction products were removed from the reaction zone by a helium flow. The resultant gas was analyzed on a VTI-2 gas analyzer, and the liquid products and solid residues were examined by the spectral method on a UR-20 instrument. Thermal analysis indicated that in the presence of KCl, thermal breakdown of the oil shale occurred more intensively in the temperature interval from 200 to 520°C and particularly between 350 and 520°C. (These stages correspond to the decomposition of the shale's organic matter.) To determine the effect of potassium chloride on the yield and makeup of the processing product, the coking process was divided into three temperature intervals (20 to 350, 350 to 550, and 550 to 750°C). Deeper thermal breakdown of the shale's organic matter was found to begin as early as in the first stage. The relative increase in the yield of liquid products amounted to 33.2%. By the end of stage 2 (in the presence of 1% KCl), the further increase in the yield of principal shale decomposition products had reached 51.1%. Intensive decomposition of the modified shale specimen was not observed in stage 3, which led the authors to conclude that these processes had been completed in the earlier stages. KCl thus proved to intensify the destruction of the oil shale's organic matter beginning at lower temperatures and prevent the formation of high-molecular weight compounds. The addition of 1% KCl was found to be the most effective with respect to the oxygen-containing fragments of the oil shales' organic matter, promote an increase in the yield of thermolysis products, and increase the concentration of heteroatomic compounds in resin and the content of unsaturated hydrocarbons in gas. Figure 1, tables 4; references 4 (Russian).

### The Effect of the Self-Oxidation of Peat During Storage on Makeup and Properties of Raw Peat Wax

917M0140D Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA KHIMICHESKIKH NAUK in Russian No 2, Mar-Apr 91 (manuscript received 5 Nov 90) pp 95-99

[Article by I.I. Lishtvan, P.L. Falyushin, A.P. Gavrilchik, T.A. Piskunova, and V.B. Kuntsevich, Institute of the Problems of Using Natural Resources and Ecology, BSSR Academy of Sciences]

UDC 662.73.017

[Abstract] The authors of the study reported herein examined the effect that self-oxidation of peat during long-term storage has on the yield and properties of raw peat wax. The study was conducted on raw material obtained by milling at the Valeryany section of the Slutskiy Peat Briquette Plant in the BSSR in 1985-1987. The bed consisted of cotton grass-sphagnum peat with a decomposition ranging from 25 to 35%. Its water was

extracted by using BR-2 benzene in a Greffe device (Republic Standard [RST] BSSR 6-56-86). Analysis of the average peat wax content in 24 stacks revealed that the amount of wax decreased as the peat' temperature and storage time increased. The authors derived the following expression for the temperature and storage time dependence of the decrease in wax content:

$$\ln(B_0 - B_T) = -17.6 + 1.24\ln\tau + 2.64\ln t \pm 0.045,$$

where  $B_0$  and  $B_T$  are the initial and ultimate wax contents, respectively;  $\tau$  is the storage time in days; and  $t$  is the self-heating temperature in °C. The multiple regression coefficient amounts to 0.0887. The most significant change took place in piles with a self-heating temperature of 82°C and at a depth of 0.6 to 1.0 m. The decrease in peat wax yield during the storage of milled peat was associated with the polymerization of resinous substances and the formation of benzene-soluble products. Normal fatty acid with eight to 38 carbon atom were identified in acids obtained from the starting peat and from the peat heated up to 82°C. The concentration maximum for the wax acids from the heated peat was shifted closer to the low-molecular weight region. This was hypothesized to occur at the expense of oxidation of alcohols, whose content was reduced in the wax obtained from the heated peat. To eliminate the self-heating of peat that occurs when milling is used to obtain bituminous raw material, the authors recommend that prophylactic measures be taken to keep the peat from self-heating during storage or else to prepare bituminous raw peat in the form of pieces that would not be subject to self-heating. Figure 1, tables 2; references 9: 8 Russian, 1 Western.

#### Composite Current-Conducting Coatings

917M0140E Minsk IZVESTIYA AKADEMII NAUK  
BSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 2, Mar-Apr 91 (manuscript received 1 Oct 90)  
pp 103-106

[Article by G.G. Mamedova, S.P. Rodtsevich, and L.G. Khodskiy, Institute of General and Inorganic Chemistry, BSSR Academy of Sciences]

UDC 666.59:621.396.692(088.8)

[Abstract] The use of glass-, ceramic-, and metal powder-based current-conducting coatings on extended electric heating elements is limited by the need to use expensive metals such as gold, silver, platinum, etc. In an attempt to find economically feasible materials for use in current-conducting coatings, the authors of the study reported herein examined the possibility of developing new composite current-conducting coatings. For their studies, the authors selected sections of the following systems: metal powder (type PMM)-amorphous boron-clay-SiO<sub>2</sub> with 80% metal by weight and metal powder-amorphous boron-clay-SiO<sub>2</sub>-Me<sub>2</sub>O<sub>3</sub>w with 80% metal by weight and 8 percent clay by weight. Specifically, their goal was to determine specific resistance and study aging in the two

systems. The highest resistance was found to be possessed by composition containing 2% boron or more. Replacing aluminum or silica with boron results in a decrease in resistance. The same phenomenon was observed when silica was substituted for clay. The optimal roasting temperature range from the standpoint of producing those specimens that are least prone to aging appeared to be between 830 and 950°C, i.e., the temperature at which the lowest post-roasting resistance was observed. Aging was also found to depend on operating temperature: The higher the operating temperature of the heater, the more intense the aging of the coating. Figures 3; references 7: 5 Russian, 2 Western.

#### The Technique of Gas Chromatographic Analysis of Mixtures of Oxygen and Nitrogen Oxides

917M0140F Minsk IZVESTIYA AKADEMII NAUK  
BSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 2, Mar-Apr 91 (manuscript received 4 May 90)  
pp 114-116

[Article by S.G. Novikov, V.V. Saskovets, I.I. Brazovskiy, and N.Ya. Dubova, Nuclear Power Institute, BSSR Academy of Sciences, and Belorussia Technological Institute imeni S.M. Kirov]

UDC 543.544:545

[Abstract] The authors of this concise report describe a gas chromatographic technique to determine gaseous impurities in nitrogen oxides. The method described calls for using a system that is based on the LKhM-72 gas chromatograph and that also includes a reaction column made of Cr18Ni10Ti stainless steel. The silochrome S-120 is used as the sorbent, and helium is used as the carrier gas. The system described can determine O<sub>2</sub>, N<sub>2</sub>O, NO, and NO<sub>2</sub> in a liquid sample with a volume of 5 x 10<sup>-3</sup> ml or in a gas sample with a volume of 2 ml. The analysis described may be completed in 4 minutes, and the method has a sensitivity of 10<sup>-3</sup>%. The method described is distinguished from currently used methods by its simplicity and higher efficiency. The new system produces higher-quality chromatograms that can be analyzed faster and with fewer processing errors. References 4 (Russian).

#### Electrical and Electrochemical Properties of Powder Oxide Electrodes Based on Modified Lanthanum Manganite

917M0140G Minsk IZVESTIYA AKADEMII NAUK  
BSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 2, Mar-Apr 91 p 117

[Synopsis of paper No. 4395-V 90 by A.A. Perunovskaya, P.P. Zhuk, and A.A. Vecher, Physical Chemistry Problems Institute imeni V.I. Lenin, Vilnius State University, deposited in the VINITI on 1 Aug 1990]

UDC 541.135.5-165

[Abstract] The electrical and electrochemical properties of  $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$  ( $x = 0$  to  $0.5$ ) powder electrodes with fraction sizes of  $<70$ ,  $70$ - $125$ ,  $125$ - $250$ , and  $>25$   $\mu\text{m}$  at the interface with an oxygen-conducting solid electrolyte have been obtained and studied. A special cell and three-electrode scheme were used to determine the powder electrodes' polarization characteristics. The polarization of the powder electrodes was studied by the method of extracting polarization curves in a dynamic potential mode at a voltage of  $0$  to  $0.10$  V. The authors establish the insignificant effect of the strontium dopant on the polarization characteristics of  $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$  at the interface with a solid electrolyte of the composition  $\text{Zr}_{0.85}\text{Y}_{0.15}\text{O}_{1.925}$  at temperatures above  $900$  when  $x \geq 0.1$ .

It is shown that as the size of the powder electrode fractions decreases, the polarization resistance of strontium-doped lanthanum manganite electrodes decreases regularly throughout the entire composition and temperature range studied. Figures 10, references 22.

**The Effect of the Nature of the Reducing Agent and Stabilizing Additives on the Laws Governing the Chemical Precipitation and Microstructure of Thin Nickel Films**

917M0140H Minsk IZVESTIYA AKADEMII NAUK  
BSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 2, Mar-Apr 91 pp 117-118

[Synopsis of paper No. 5019-V 90 by N.V. Amelina, T.N. Vorobyeva, and T.V. Gayevskaya, Physical Chemistry Problems Institute imeni V.I. Lenin, Vilnius State University, deposited in the VINITI on 12 Sep 90]

UDC 621.793

[Abstract] The authors examine the nature of the effect that the reducing agent (sodium borohydride, hydrazine borane, sodium hypophosphite, dimethylaminoborane) and various additives acting as stabilizers of chemical precipitation solutions (5-nitrobenzimidazole, 2-mercaptobenzimidazole, alkyl dimethylamine oxide) have on the laws governing the growth of thin nickel films. It is established that the precipitation of nickel occurs either by the growth of nucleation centers (which is characteristic of hypophosphite solutions) or else by the formation of new nucleation centers on the surface and at the junctions of previously formed particles (which is clearly for all solutions with boron-containing reducing agents).

The authors express a judgment regarding the possibility of forecasting the effect of stabilizing additives on the microstructure of films precipitated from hypophosphite solutions and from solutions with boron-containing reducing agents. Figures 8, table 1; references 5.

**A Comparative Study of Methods of Synthesizing  $\text{LnBa}_2\text{Cu}_3\text{O}_{7-y}$  ( $\text{Ln} = \text{Y, Eu, Dy}$ )**

917M0140I Minsk IZVESTIYA AKADEMII NAUK  
BSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 2, Mar-Apr 91 p 118

[Synopsis of report No. 5825-V 90 by S.P. Tolochko, A.S. Lyakhov, V.A. Lomonosov, I.F. Kononyuk, A.I. Lesnikovich, and L.V. Makhnach, Institute of General and Inorganic Chemistry, BSSR Academy of Sciences, and Physical Chemistry Problems Institute imeni V.I. Lenin, Vilnius State University, deposited in the VINITI on 19 Nov 90]

UDC 538.945+546.65.56.21

[Abstract] Research was conducted on the phase composition of products of the solid-phase reactions occurring during the production of  $\text{YBaCu}_3\text{O}_{7-y}$  from mixtures distinguished by the nature of their starting components (ceramic technology), mixtures that were first subjected to chemical homogenization (the citrate method, coprecipitation of carbonates), and mixtures in which yttrium was replaced by europium and dysprosium. The x-ray phase analysis method was used to study the kinetics of the formation of  $\text{LnBa}_2\text{Cu}_3\text{O}_{7-y}$  ( $\text{Ln} = \text{Y, Eu, Dy}$ ) from eight systems in air and in nitrogen at  $860^\circ\text{C}$ ,  $910^\circ\text{C}$ , and during slow cooling. The rate of formation of the phase 123 was demonstrated to be at its slowest in carbonate-containing compositions. The formation rate increased in the case of chemically homogenized compositions and reached its maximum for  $\text{EuBa}_2\text{Cu}_3\text{O}_{7-y}$  for synthesis under identical conditions. The formation rate of  $\text{LnBa}_2\text{Cu}_3\text{O}_{7-y}$  increased significantly as the synthesis temperature increased and as the partial pressure of oxygen decreased ( $T \leq 860^\circ\text{C}$ ). Thanks to its higher stability, the compound  $\text{EuBa}_2\text{Cu}_3\text{O}_{7-y}$  was produced in nitrogen at  $910^\circ\text{C}$  within 2 hours.

Electric conduction was studied as a function of duration of synthesis and specimen preparation conditions. The synthesis method was observed to have a significant effect on the temperature and width of the transition into a superconductive state for a roentgenographically pure phase. Figures 5, table 1; references 22.

**Mechanisms of the Alteration of the Deep Layers of a Solid During Ion Bombardment**

917M0141A Moscow POVERKHNOST: FIZIKA,  
KHIMIYA, MEKHANIKA in Russian No 4, Apr 91  
(manuscript received 19 Feb 90) (after revision  
15 May 90) pp 44-50

[Article by Yu.V. Martynenko and P.G. Moskovin, Atomic Energy Institute imeni I.V. Kurchatov, Moscow]

UDC 539.09.082

[Abstract] The authors of the study reported herein examine the mechanism of the accelerated diffusion of



an impurity that can occur at high current densities when the concentration of impurities reached is so great that their interaction results in their repulsion from the implanted layer to the depth of the specimen. Also examined is a new mechanism of formation of a dislocation structure at a depth up to about 100  $\mu\text{m}$  under a surface irradiated by an ion beam. It is hypothesized that the dislocation loops generated in the area of the cascades of atomic collision are repulsed into the depths of the specimen on account of the interaction. Once in the depths of the specimen, these loops stop, attach to the specimen's initial dislocations and to one another, and form a well-developed dislocation structure. The impurities implanted into the matrix are more or less dilation centers. In other words, they have atomic volumes that differ from the volume of the lattice atom proper. Because of this, an elastic stress field is formed around each impurity atom. This in turn leads to mutual repulsion of the atoms. Although the reaction is characteristic of all impurities, it is evidently most prominent in the case of chemically negative impurities. According to the proposed model, the interaction of impurities with one another and with the matrix lattice is elastic in nature. The energy of the interaction of two impurity atoms changes their chemical potentials. The chemical potential gradient then generates a force that acts upon the impurities. The details of this model are explained through a series of equations and a discussion of experiments showing that the maximum penetration depth of the loops and formation of the dislocation structure increases slowly as the irradiation dose is increased and that heavy ions are likely to be associated with the formation of dislocation loops and will have a lesser maximum penetration depth than is the case for light ions. Figures 2; references 14: 11 Russian, 3 Western.

#### Rainbow Effects During the Scattering of Atoms by a Surface

917M0141B Moscow *POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA* in Russian No 4, Apr 91 (manuscript received 10 Apr 89) (after revision 22 Nov 89) pp 51-58

[Article by Yu.Ye. Gorbachev, Physical Technical Institute imeni A.F. Ioffe, USSR Academy of Sciences, Leningrad]

UDC 533.536.423.1

[Abstract] Other researchers have expressed an interest in using what has been termed rainbow scattering effects to diagnose surfaces by using beams of low-energy neutral particles. In a continuation of this line of investigation, the author of the study reported herein considered a number of distinctions in the scattering pattern of light atoms caused by the deviation of the law governing their oscillations from a sinusoidal law. Through an analysis based on a multidimensional quasi-classical integral representations for the T-amplitude of scattering, the author has managed to demonstrate that even in the

absence of energy exchange with the surface, such oscillations result in the appearance of sharp rainbow maxima that are linked to the probability of scattering in an angular (energy) dependence. He goes on to suggest that the effect described should also be observed for a cold surface in cases where the zero oscillations of the surface are significant. Identification of such maxima makes it possible to obtain information about the parameters of the potential. The analysis performed is extended to the case of scattering on surfaces with a nonsinusoidal profile and on superlattices. Also described are the behavioral distinctions of a mirror diffraction peak as a function of that component of a falling-frequency pulse that is normal to the surface. Figure 1; references 16: 8 Russian, 8 Western.

#### The Effect of the Topography of an Irradiated Surface on the Angular Distribution of Sputtered Material

917M0141C Moscow *POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA* in Russian No 4, Apr 91 (manuscript received 21 Feb 90) (after revision 31 May 90) pp 59-64

[Article by A.V. Sidorov, Nuclear Physics Scientific Research Institute, Moscow State University imeni M.V. Lomonosov, Moscow]

UDC 547.534

[Abstract] This article presents a theoretical investigation of the effect of the topography of an irradiated surface on the angular distributions of the sputtered material. Two forms of the distribution of the intensity of sputtered particles on a smooth surface are examined: a conical distribution and the results of modeling using the TRIM.SP program. The analysis results confirmed that the topography of the irradiated surface does indeed affect the form of the differential output of sputtered particles. Changes in the angular distribution of sputtered material are associated with screening of the sputtered particles by the adjacent faces. They are most dependent, however, on the shape of the angular distribution of the intensity of the sputtered particles and on the angles during establishment of ridges on the target surface. If the sputtering coefficient is inversely proportional to the cosine of the angle of incidence and the angular distribution of the sputtered particles follows a cosine law, the shape of the angular dependence of the differential output of sputtered material will only be very weakly dependent on the parameters of the surface structure. Giving more correct consideration to the effect of surface topography on the sputtering process requires knowledge of the surface structure before and after irradiation and knowledge of the degree to which the entire target surface is filled with inhomogeneities. Also important are the answers to the questions of how the process of the formation of inhomogeneities on a surface unfolds over time and what contribution structures with different porosities make over time. Having

the answers to these questions will make it possible to determine the qualitative and quantitative effects of the topography of an irradiated surface for each concrete case. Figures 4; references 11: 3 Russian, 8 Western.

#### The Structure of Thin Metal Films in the System Al/SiO<sub>2</sub>/Si in Connection With Their Resistance to Electrical Degradation

917M0141D Moscow *POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA* in Russian No 4, Apr 91 (manuscript received 30 May 88) (after revision 22 Nov 89) pp 77-85

[Article by A.I. Ilin, Ye.E. Glikman, I.Yu. Borisenko, N.D. Zakharov, and V.V. Starkov, Institute of the Problems of Microelectronics Technology and Especially Pure Materials, USSR Academy of Sciences, Chernogolovka, and Crystallography Institute, USSR Academy of Sciences, Moscow]

UDC 548.732-620.187.5

[Abstract] The transmission electron microscopy method was used to determine those grain structure parameters of thin Al and Al-4% Cu films that determine the life of the wiring of integrated circuits during electrical degradation. The aforesaid films were sputtered by a high-frequency magnetron at argon pressures of  $5 \times 10^{-2}$  Pa and a discharged power of about 1 kW. They were sputtered onto silicon base 370  $\mu\text{m}$  thick with a crystallographic orientation of  $\langle 100 \rangle$  that had previously been coated with an SiO<sub>2</sub> film 0.2  $\mu\text{m}$  thick. Before the sputtering, the bases were heated to 130° and subjected to ion-plasma etching for 50 seconds at a voltage on the base of 300 V and a power of 200 W. Cross-sectional specimens of the said films were prepared and subjected to transmission electron microscopy. Increasing the argon pressure from 0.05 to 7 Pa was found to reduce the average rate of magnetron sputtering of aluminum and, consequently, the thickness of films sputtered within a specified time period. As the film thickness decreased, the average grain size of the Al films increased while the average grain size of the Al-4% Cu films decreased. Argon pressure and 4% Cu doping were found to affect grain size distribution both in the plane of the film and in the normal to the surface. Argon pressure was also found to affect surface roughness: average surface roughness increased as the pressure decreased. At  $P = 7$  Pa the films glittered; they were matted at  $P = 0.05$  Pa. Small-scale surface roughness was associated with different rates of vertical grain growth, whereas large-scale surface roughness was attributed to the formation of annealing hillocks where the film was heated during the sputtering process. The films doped with 4% Cu were not affected by this type of large-scale roughness; rather, they were only characterized by the small-scale roughness resulting from uneven grain growth. Figures 4, tables 2; references 10: 4 Russian, 6 Western.

#### The Effect of Plasma Treatment on the Spectrum of Electronic States in Silicon

917M0141E Moscow *POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA* in Russian No 4, Apr 91 (manuscript received 4 Sep 89) (after revision 26 Oct 89) pp 86-89

[Article by Kh.A. Abdullin, A.P. Koka, B.N. Mukashev, M.F. Tamendarov, and T.B. Tashenov, Institute of High-Energy Physics, KaSSR Academy of Sciences, Alma-Ata]

UDC 621.315.592

[Abstract] The authors of the study reported herein used the method of deep-level transient-capacitance spectroscopy [DLTS] to study the changes in the electronic states of silicon exposed to hydrogen and helium plasma. Phosphorus- and boron-doped silicon specimens grown by the Czochralski method were subjected to hydrogen or helium treatment in glow discharge or high-frequency discharge plasma in an argon medium. The temperature of the specimens and the current and power of the discharges were controlled during the treatment process. The discharge voltage was varied from 100 V to 2 kV, and the current was varied from 0.1 to 0.5 mA/cm<sup>23</sup>. To measure the DLTS spectra of the specimens undergoing plasma treatment, Schottky barriers were formed by sputtering Au and Al onto Si of types n and p conduction, respectively. The precision of determining the levels' energy position amounted to  $\pm 0.01$  eV. After plasma treatment, even those specimens that did not initially contain deep levels in their DLTS spectra were found to contain large number of peaks corresponding to free-carrier traps. The spectra obtained did not fully coincide with those obtained previously and reported elsewhere. The concentration of defects was at the level of  $10^{-3}$  the concentration of shallow-level impurities with the exception of the E1 and E2 centers in n-type silicon. Defects formed by plasma treatment were located at a depth up to 2 to 4  $\mu\text{m}$ ; their concentration grew nearer to the surface. The appearance of defects at such depths was attributed to radiation-stimulated diffusion, during which both intrinsic and impurity defects migrate from a surface layer subjected to intensive ion bombardment and containing a high concentration of vacancies and interstitial atoms. This migration in turn results in the formation of a broad spectrum of electronic states in the forbidden band. Formed at the same time are a large number of electrically inactive centers that affect the kinetics of defect formation. The plasma treatment of Czochralski-grown n-type silicon specimens thus created a high concentration of electron traps with energies of 0.12 and 0.14 eV. Impurity carbon and oxygen atoms were found to be included in them. The concentration of defects was found to depend on the gaseous medium of the plasma: a much greater quantity of electrically active defects was formed during hydrogen treatment than were formed in the case of treatment in Ar<sup>+</sup> and He<sup>+</sup>. This was attributed to their passivation by hydrogen. Figures 4; references 6 (Russian).

**Theoretical Modeling of Laser-Initiated Precipitation of Metal Films From the Gaseous Phase Onto an SiO<sub>2</sub> Surface**

917M0141F Moscow *POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA* in Russian No 4, Apr 91 (manuscript received 3 Aug 89) (after revision 2 Feb 90) pp 116-120

[Article by Ye.A. Volkova, A.S. Kovalev, and A.M. Popov, Scientific Research Institute of Nuclear Physics, Moscow State University imeni M.V. Lomonosov, Moscow]

UDC 621.382

[Abstract] The authors of the study reported herein develop a theoretical model of laser-initiated pyrolytic precipitation of metal layers from the gaseous phase onto an SiO<sub>2</sub> surface. According to the model, continuous-wave laser radiation is absorbed by an already-existing metallization layer. As a result of heat conduction, the areas adjacent are heated. Thus this process of the creation of a metal path on the SiO<sub>2</sub> surface may be looked upon as the formation of a "metallization wave" and may be considered an analogue of the process of the propagation of a discharge in a slow-burn mode. The authors proceed to compute the dependences of the thickness of the metallization layer on the intensity of the radiation and the velocity of the beam along the surface during pyrolysis of tungsten hexacarbonyl. The computations presented are based on the case of the precipitation of tungsten from tungsten hexacarbonyl (W(CO)<sub>6</sub>) with a saturated-vapor pressure of  $\approx 0.035$  torr at a vapor temperature of 20°. Figures 4; references 14: 1 Russian, 13 Western.

**Angle-Resolved Electron Energy Loss Spectroscopy Investigation of GaAs(110)**

917M0141G Moscow *POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA* in Russian No 4, Apr 91 (manuscript received 28 Jul 89) (after revision 23 Apr 90) pp 145-147

[Article by O.M. Artamonov, V.A. Novolodskiy, O.Yu. Rayskiy, and A.N. Terekhov, Leningrad State University]

UDC 537.533.8

[Abstract] The authors of this concise report used the method of angle-resolved electron energy loss spectroscopy [EELS] to study GaAs(110). Their work was based on a spectrometer with angle resolution and a changeable experiment geometry. For grazing angles, they detected a surface plasmon excitation threshold at  $E_p = 80$  eV. This threshold was associated with the spreading of the electron concentration profile close to the surface ( $\approx 3$  angstroms). By analyzing the angle and energy dependences of the EELS spectra obtained, the authors were able to identify characteristic losses (at 6.2 and 3.5 eV)

associated with the excitation of interband transitions on a relaxed GaAs(110) surface. They also identified the presence of an interband transition with an energy of 8.5 eV. This transition was determined to take place both on the relaxed surface and in the bulk of the GaAs(110). Figures 2; references 9: 5 Russian, 4 Western.

**Electron Bombardment-Induced Charging of Near-Surface Elastically Deformed Layers of Silicon Dioxide**

917M0141H Moscow *POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA* in Russian No 4, Apr 91 (manuscript received 8 Jan 90) (after revision 22 May 90) pp 150-152

[Article by A.F. Zatsepin, V.S. Kortov, V.V. Tyukov, and G.B. Cherlov, Ural Polytechnic Institute, Sverdlovsk]

UDC 537.533.2+539.319

[Abstract] Modeling electron bombardment-induced electrical fields in dielectrics is important in research on radiation effects in elastically deformed materials. The authors of this concise report calculated the electrical field and charge induced by irradiating silicon dioxide with an electron beam possessing average energies of 1 to 10 keV. The effect of elastic stress fields was simulated by varying the mean depth of the yield of secondary electrons ( $\lambda_0$ ). The value  $\lambda_0 = 50$  angstroms was determined to correspond to the equilibrium state of SiO<sub>2</sub>,  $\lambda_0 = 40$  angstroms was associated with an elastically compressed surface layer, and  $\lambda_0 = 70$  angstroms was linked with an elastically extended surface layer. It was discovered that layers having tensile stresses in the near-surface region ( $x < 50$  angstroms) developed a negative charge. In a "minus-plus-minus" structure, this negative charge in the near-surface layer is two orders of magnitude greater than the analogous charge at depths greater than 490 angstroms. No near-surface negative charge was found in the case of compressive stresses. The degree in the total charge in the near-surface layers of SiO<sub>2</sub> that occurs under conditions of compressive stresses and the increase in total charge that occurs in the presence of tensile stresses confirms that charge separation processes are impeded in elastically compressed dielectrics. At the same time, there is an increased probability of recombination of charges with different signs as the structural units in which these charges are localized are moved closer together. Figures 2; references 7: 6 Russian, 1 Western.

**Producing Lanthanum and Yttrium Cuprates Under Conditions of High Pressures and Temperatures**

917M0154A Moscow *ZHURNAL NEORGANICHESKOY KHIMII* in Russian Vol 36 No 5, May 91 (manuscript received 9 Jul 90) pp 1091-1095

[Article by T.V. Dyachkova, N.I. Kadyrova, N.V. Talashmanova, S.I. Alyamovskiy, and Yu.G. Zaynulin, Chemistry Institute, Ural Department, USSR Academy of Sciences, Sverdlovsk]

UDC 539.1+541.12+536.6

[Abstract] In view of the promise of the technology of high pressures and temperatures with respect to producing high-temperature superconductors, the authors of the study reported herein attempted to synthesize lanthanum and yttrium cuprates under pressures of 1.0 to 5.0 GPa, temperatures ranging from 800 to 1,000°C, and synthesis times ranging from 10 to 30 minutes. As starting substances for the synthesis of lanthanum cuprates, the authors used a mixture of the oxides  $\text{La}_2\text{O}_3$ ,  $\text{CuO}$ ,  $\text{CaO}$ ,  $\text{SrO}$ ,  $\text{Pb}_2\text{O}_4$ , and  $\text{BaO}_2$  that were produced individually by roasting the respective carbonates at 800°C for 2 hours. The test yttrium cuprates were synthesized from  $\text{Y}_2\text{O}_3$ ,  $\text{BaO}_2$ , and  $\text{CuO}$ . Under the conditions of the experiments conducted, lanthanum cuprates ( $\text{La}_2\text{CuO}_4$  and  $\text{La}_{1.8}\text{Pb}_{0.2}\text{CuO}_4$ ) were found to crystallize in orthorhombic systems, whereas the phases  $\text{La}_{1.8}\text{Ca}_{0.2}\text{CuO}_4$  and  $\text{La}_{1.8}\text{Sr}_{0.2}\text{CuO}_4$  crystallized in a tetragonal system. The yttrium cuprate synthesized ( $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$ ) had a tetragonal structure. The compositions and structure of the cuprates synthesized are summarized in tabular form and discussed in detail. Figure 1, tables 2; references 17: 4 Russian, 13 Western.

#### Dependence of the Temperature of Transition to a Superconductive State on the Degree of Chemical Bonds' Metallicity

917M0154B Moscow ZHURNAL  
NEORGANICHESKOY KHIMII in Russian Vol 36  
No 5, May 91 (manuscript received 11 Oct 90)  
pp 1096-1098

[Article by Ye.V. Polyakov, R.N. Pletnev, A.A. Fotiyev, F.A. Rozhdestvenskiy, and G.P. Shveykin]

UDC 537.312.62:541.9

[Abstract] The authors of the study reported herein attempt to use a somewhat expanded version of Pauling's scale of electronegativities to analyze the characteristics of superconductors. The authors state that using Pauling's electronegativity scale to estimate the degree of ionicity of a bond  $\epsilon$  during the paired interaction of components of a compound of the type  $\text{M}_k\text{X}_l$  largely solves the problem of determining the nature of the valence state of components-atoms because the scale is based on thermodynamic data about real compounds. They proceed to base their discussion on the results of quantitative determinations of the electronegativity of an electron  $\chi_E$  and degree of metallicity  $\mu$  of simple substances and compounds. The authors conclude that the empirical criterion  $[\lg]m = 0.67 \pm 0.08$  is a necessary (albeit insufficient) condition for the presence of superconductive properties in a substance. They go on to state that it may possibly be helpful in finding new superconductors. They further note the importance of giving consideration to the number of components  $n$  participating in the phase transformation. Figures 2; references 12: 8 Russian, 4 Western.

#### Using Formates To Produce High-Temperature Superconductor Films

917M0154C Moscow ZHURNAL  
NEORGANICHESKOY KHIMII in Russian Vol 36  
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pp 1099-1101

[Article by A.A. Ostroushko, L.I. Zhuravleva, S.M. Portnova, and Yu.I. Krasilov, Ural State University imeni A.M. Gorkiy and General and Inorganic Chemistry Institute imeni N.S. Kurnakov, USSR Academy of Sciences]

UDC 621.313(088.8)

[Abstract] The authors of the study reported herein examined the possibility of using yttrium, barium, and copper (II) formates to synthesize  $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$  films on bases made of  $\text{MgO}$  and  $\text{Al}_2\text{O}_3$ . Because the aforesaid formates are all easily soluble compounds, they had to be studied in the form of titrated aqueous solutions of a mixture of salts or else prepared based on exact weighted portions. The working solution concentrations used amounted to 0.018, 0.023, 0.030, and 0.045 mol/l calculated for  $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ . To further improve the film-forming capabilities of the substances used, a polymer surfactant was added to them by means of a 10% (by weight) aqueous solution of polyvinyl alcohol.  $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$  films were formed on polished monocrystalline  $\text{MgO}$  bases with an orientation of  $\langle 100 \rangle$  and on  $\text{Al}_2\text{O}_3$  with a barrier sublayer of  $\text{ZrO}_2$  (doped with  $\text{Y}_2\text{O}_3$ ). The working solutions were applied layer by layer under a pressure of 7 atm. After repeated heating and application cycles, the specimens were subjected to final heat treatment in oxygen for 15 minutes at 900-950°C for 15 minutes and at 400-500°C for 4 hours. It was discovered that the  $\text{MgO}$  bases could withstand a higher pyrolysis process temperature than the  $\text{Al}_2\text{O}_3$  bases could. The optimal temperature range for the  $\text{MgO}$  base turned out to be between 600 and 950°C, whereas the allowable pyrolysis temperature could not exceed 450°C for the  $\text{Al}_2\text{O}_3$  bases. The use of formate solutions in producing high-temperature superconductors was found to afford a number of advantages. Specifically, they maintained a uniform phase composition throughout the pyrolysis process, did not possess any impurity phases, and were included to form glassy amorphized layers without fine crystallization. Measurements of the critical current in the films produced (thickness, 2 to 5  $\mu\text{m}$ ) yielded a value of at least 2 to 5  $\times 10^4$  A/cm<sup>2</sup> for a zero magnetic field maintained for a year (which indicates their stability). Depending on the heat treatment conditions used, the temperature of the superconductive transition ranged from 77 to 85 K ( $\Delta T_c \approx 2$  K). Figures 2, table 1; references 14: 8 Russian, 6 Western.

**Mechanism of the Entry of Yttrium Ions Into Barium Cuprate  $\text{Ba}_2\text{Cu}_3\text{O}_y$**

917M0154D Moscow ZHURNAL  
NEORGANICHESKOY KHIMII in Russian Vol 36  
No 5, May 91 (manuscript received 3 Sep 90)  
pp 1102-1106

[Article by L.A. Klinkova, Solid-Field [sic] Physics Institute, USSR Academy of Sciences, Chernogolovka]

UDC 669.018.537.312.62

[Abstract] A series of works have been devoted to the nature of high-temperature superconduction in the compound  $\text{YBa}_2\text{Cu}_3\text{O}_y$ . In a continuation of this line of research, the authors of the study reported herein attempted to discover the correspondence of the valence state of copper and oxygen ions in  $\text{Ba}_2\text{Cu}_3\text{O}_y$  to that in  $\text{YBa}_2\text{Cu}_3\text{O}_y$ . The authors also examined the possibility of controlling the behavior of yttrium in  $\text{YBa}_2\text{Cu}_3\text{O}_y$ . For their studies, they used barium cuprates with the compositions  $\text{BaCuO}_y$ ,  $\text{Ba}_2\text{Cu}_3\text{O}_y$ , and  $\text{BaCu}_2\text{O}_y$  that were prepared from ultrapure  $\text{BaO}_2$  and analytic-grade  $\text{CuO}$ . They present data on the content of peroxide-like oxygen ( $\text{O}_2^{2-}$ ) in the barium cuprates. The data presented were calculated by using a material balance equation based on experimental data about their content of total oxygen and  $\text{Cu}^{\text{III}}$  ions. A correspondence between the number of ( $\text{O}_2^{2-}$ ) ions in  $\text{Ba}_2\text{Cu}_3\text{O}_y$  and the yttrium ions in the superconductor  $\text{YBa}_2\text{Cu}_3\text{O}_y$  is discovered. The authors set forth what they propose as the mechanism of the entry of yttrium into barium cuprate. The synthesis of  $\text{Ba}_2\text{Cu}_3\text{O}_y$  in an orthorhombic modification is observed in a  $\text{BaO}_2$ - $\text{CuO}$  mixture at a temperature of 550 to 870°C. At a temperature of 880 to 900°C,  $\text{Ba}_2\text{Cu}_3\text{O}_y$  has the structure of a cube. Yttrium oxide dissociates in the presence of a melt. The  $\text{Y}^{\text{III}}$  ion formed in the process is "pulled into" the  $\text{YBa}_2\text{Cu}_3\text{O}_{5.5}$  barium cuprate by the  $\text{O}_2^{2-}$  hole present in it. The subsequent violation of the condition of electroneutrality of the crystal nucleus results in a jump-like change in the state of the copper ion ( $\text{Cu}^{\text{II}} \rightarrow \text{Cu}^{\text{III}}$ ) that in turn causes the lattice to absorb oxygen (in an amount equal to one atom) from the environment. When this happens, the  $\text{Ba}_2\text{Cu}_3\text{O}_{5.5}$  becomes  $\text{YBa}_2\text{Cu}_3\text{O}_{6.5}$ , but its structure remains tetragonal. During the process of cooling to 400-500°C the  $\text{YBa}_2\text{Cu}_3\text{O}_{6.5}$  cuprate undergoes a phase transition to an orthorhombic structure. This transition is accompanied by the formation of  $\text{Cu}^{\text{III}}$  ions and additional absorption of oxygen by the lattice in the amount of 0.16 atoms, which results in a compound with the makeup  $\text{YBa}_2\text{Cu}_3\text{O}_{6.6}$ . This oxygen content lies within the range of existing values for  $\text{YBa}_2\text{Cu}_3\text{O}_{7.8}$  of an orthorhombic superconductive phase ( $0.65 > \delta > 0.15$ ). The oxygen index of the  $\text{YBa}_2\text{Cu}_3\text{O}_y$  compound depends on the annealing conditions (temperature and time). Figures 2, tables 4; references 14: 6 Russian, 8 Western.

**The Content of Oxygen and Bismuth (V) in Binary Barium-Bismuth Oxides**

917M0154E Moscow ZHURNAL  
NEORGANICHESKOY KHIMII in Russian Vol 36  
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pp 1107-1111

[Article by L.A. Klinkova and N.V. Barkovskiy, Solid-State Physics Institute, USSR Academy of Sciences, Chernogolovka]

UDC 669.018:537.312.62

[Abstract] In view of the interest aroused by barium-bismuth oxides in connection with the discovery of superconductivity in the system K-Ba-Bi-O, the authors of the study reported herein examined the change in the oxygen and  $\text{Bi}^{\text{(V)}}$  content in binary barium-bismuth oxides with Ba:Bi ratios of 3:2, 1:1, 2:3, and 1:2.  $\text{Ba}_3\text{Bi}_2\text{O}_y$ ,  $\text{BaBiO}_y$ ,  $\text{Ba}_2\text{Bi}_3\text{O}_y$ , and  $\text{BaBi}_2\text{O}_y$  were synthesized during a process of melting mixtures of bismuth (III) oxide with barium peroxide, carbonate, or nitrate of a specified composition in air followed by annealing in oxygen at temperatures between 400 and 900°C. The method of determining the substance's weight change throughout the stages of heat treatment was used to determine the oxygen content of the resultant specimens. Chemical analysis was used to determine the content of total bismuth and bismuth (V) in the binary oxides. The maximum amount of oxygen in the specimens was achieved at the moment of the phase transition (at about 450°C) into a cubic system. The authors established that the oxygen index ( $y$ ) varies within the intervals from 5.46 to 7.70, 2.32 to 2.92, 5.52 to 7.19, and 3.59 to 4.43 and that the  $\text{Bi}^{\text{(V)}}$  content ranges from 10.3 to 66.7, 0 to 42.6, 0 to 29.0, and 0 to 13.3% (by weight) of the total amount of bismuth, respectively. A correlation was generally observed between the quantity  $y$  and the  $\text{Bi}^{\text{(V)}}$  content. On the basis of their experiments, the authors concluded that using  $\text{BaO}_2$  as a barium-containing reagent yields barium-bismuth oxides with a reduced oxygen content and elevated  $\text{Bi}^{\text{(V)}}$  content. The amounts of  $\text{Bi}^{\text{(V)}}$  that the authors found in the binary barium-bismuth oxides produced during their experiments are much less than those found by the authors of studies published elsewhere. This discrepancy is deemed to be likely due to methodological errors in the volumetric analysis used to determine "active" oxygen, the amount of which is correlated with  $\text{Bi}^{\text{(V)}}$ . Figures 2, tables 2; references 11: 4 Russian, 7 Western.

**Mechanism of Reduction of Elemental Selenium by Aluminum in Alkaline Solutions**

917M0154F Moscow ZHURNAL  
NEORGANICHESKOY KHIMII in Russian Vol 36  
No 5, May 91 (manuscript received 1 Jun 90)  
pp 1156-1159

[Article by V.P. Gladyshev, S.V. Kovaleva, and L.M. Krut, Melitopol State Pedagogical Institute]

UDC 546.22:546.23:546.24

[Abstract] The authors of the study reported herein used the potentiostatic method to examine the mechanism of the reduction of elemental selenium by aluminum in alkaline solutions. They measured the redox potentials of selenium compound-containing solutions by an EV-74 ionometer with a platinum indicator electrode. A silver chloride electrode ( $E = 0.201$  V) was used for the standard electrode. Plates with an area of  $8 \text{ cm}^2$  were used for the aluminum. A suspension of gray hexagonal selenium (grade, ultrapure) ground to  $10^{-4} \text{ m}$  was produced in  $80 \text{ cm}^3$  of a 1 M solution of sodium hydroxide (grade, ultrapure). The experiment was conducted at a temperature of  $20^\circ\text{C}$ . Under these conditions, the complete reduction of selenium to monoselenide

took 60 to 80 minutes. It was discovered that when elemental selenium is reacted with aluminum in a sodium hydroxide medium, the formation of monoselenide ions entails a stage in which polyselenide ions ( $\text{Se}_n^{2-}$ , where  $n$  ranges from 12 to 2) are formed. The authors identified the aforesaid stage based on the change in the potential of the selenium-polyselenide systems over time. On the basis of the additivity of the properties of the polyselenide ions that they observed, the authors hypothesized that the dependence of the polyselenide ions' generation potential on  $n$  may be extended into the range of higher values. They proceeded to confirm this hypothesis based on experimental and calculated data. Figures 2, tables 2; references 12: 11 Russian, 1 Western.

### Reaction of Tetrabenzyluranium With Carbon Oxides

917M0135A Moscow METALLOORGANICHESKAYA  
KHIMIYA in Russian Vol 4 No 2, Mar-Apr 91  
(manuscript received 20 Mar 90) pp 323-326

[Article by M.R. Leonov and G.V. Solovyeva, Chemistry Scientific Research Institute, Gorkiy State University imeni N.I. Lobachevskiy]

UDC 547.1'13:546.791.4:541.427

[Abstract] Tetrabenzyluranium ( $Bz_4U \cdot MgCl_2$ ) is the only uranium compound of those that are stable under normal conditions to contain only  $\sigma$ -bound ligands. The authors of the study reported herein examined the possibility of carbonylation and carboxylation of  $Bz_4U \cdot MgCl_2$  by reacting it with CO and  $CO_2$  in a benzene solution in 1:1, 1:4, and 1:6 ratios. The interaction of  $Bz_4U \cdot MgCl_2$  and CO was conducted at 70°C and was completed in 30 hours; the reaction with  $CO_2$  was conducted at 25°C and took 15 hours. Under the conditions studied, only 1 mole of CO but either 1 or 4 moles  $CO_2$  was found to be absorbed per mole  $Bz_4U \cdot MgCl_2$ . In the case of a tetrabenzyluranium: $CO_2$  ratio of 1:6, the absorption of 4 moles  $CO_2$  was found to be accompanied by the splitting off of 0.5 mole  $MgCl_2$ . Electron spectroscopy data indicated that the degree of uranium oxidation does not change as a result of the reaction. IR spectroscopy data suggested that benzyl ligands were maintained in the resultant carbonylation and carboxylation products. This was confirmed by the absence of any ligand transformation products. New absorption bands detected in the frequency interval from 1,300 to 1,630  $cm^{-1}$  were classified as carbonyl group absorption bands, and a band at 470  $cm^{-1}$  was classified as a U-O bond, which agrees with data published elsewhere. Normal migration implantation into the U-C  $\sigma$ -bond was demonstrated to occur. The resultant complexes were in associated form. Tables 2; references 11: 5 Russian, 6 Western.

### $\sigma$ -Constants of Group IVB Organoelemental Substituents in Acetylene Derivatives and $\sigma, \pi$ -Conjugation

917M0135A Moscow METALLOORGANICHESKAYA  
KHIMIYA in Russian Vol 4 No 2, Mar-Apr 91  
(manuscript received 28 Mar 90) pp 362-367

[Article by A.N. Yegorochkin, S.A. Skobeleva, V.L. Tsvetkova, Ye.T. Bogorodovskiy, and V.S. Zavgorodniy, Organometallic Chemistry Institute, USSR Academy of Sciences, Gorkiy, and Technological Institute imeni Lensovet, Leningrad]

UDC 541.65:547.245:547.246:547.258.11

[Abstract] Systematic IR and UV spectroscopy and quantum chemistry studies of acetylene derivatives of the type  $R_3EC \equiv CX$  and  $R_3EC \equiv CE'R_3$  (where E and E'

represents Si, Ge, or Sn; R represents alkyl radicals; and X represents organic substituents) established the presence of two oppositely directed resonance effects of the  $R_3E$  substituents with respect to the triple bond.  $R_3E$  substituents are electron acceptors with respect to their  $d, \pi$ -conjugation mechanism and electron donors with respect to their mechanism of  $\sigma, \pi$ -conjugation. In view of these and other findings reported in the related literature, the authors of the study reported herein determined the  $\sigma$ -constants of organosilicon, organogermanium, and organotin substituents in acetylene derivatives and conducted additional research on  $\sigma, \pi$ -conjugation in ethynyl derivatives of the elements of the silicon subgroup. They calculated the  $\sigma_R^0$  (and  $\sigma_R$ ) and  $\sigma_p$  constants of the aforesaid compounds and summarized them in table form;  $\sigma_R^0$  (and  $\sigma_R$ ) characterizes the capability of  $R_3E$  substituents of entering into conjugation with a triple bond in the presence (absence) of direct polar conjugation between  $R_3E$  and the reaction center, whereas the Hammett constant  $\sigma_p$  characterizes the total electron effect (inductive and resonance) of the  $R_3E$  substituents with respect to the triple bond. The  $\sigma$ -constant was found to differ in benzene and acetylene derivatives, increasing as the atomic number of the element E increased. This difference was attributed to the increased role of the effects of  $\sigma, \pi$ -conjugation and direct polar conjugation in organoelemental acetylene derivatives. Tables 3; references 20: 10 Russian, 10 Western.

### Cyclodiorganylsilethynes ( $MeRSiCC)_n$ )

917M0135C Moscow METALLOORGANICHESKAYA  
KHIMIYA in Russian Vol 4 No 2, Mar-Apr 91  
(manuscript received 28 Mar 90) pp 368-372

[Article by M.G. Vronkov, O.G. Yarosh, L.V. Zhilit-skaya, A.I. Albanov, and V.Yu. Vitkovskiy, Irkutsk Organic Chemistry Institute, Siberian Department, USSR Academy of Sciences]

UDC 542.21 + 547.1'128]

[Abstract] This article reports the synthesis of a series of macrocyclic acetylene silicohydrocarbons of the type  $MeR-SiC \equiv C)_n$ , where R = H or Me,  $CH_2 = CH$ , and n = 4-8 or 10. They were synthesized by reacting the organomagnesium derivatives  $Me_2Si(C \equiv CMgBr)_2$ ,  $Me(CH_2 = CH)Si(C \equiv CMgBr)_2$ ,  $BrMgC \equiv CMe_2$ ,  $SiC \equiv CSiMe_2C \equiv CMgBr$ , or  $BrMgC \equiv CMe_2$   $SiC \equiv CSiMe_2C \equiv CSiMe_2C \equiv CSiMe_2C \equiv CMgBr$  with  $Me_2SiCl_2$ ,  $Me(CH_2 = CH)SiCl_2$ ,  $MeHSiCl_2$ , or  $Me_2Si(C \equiv CSiMe_2Cl)_2$ . The melting points, yields, and data from an elemental analysis of the resultant silicohydrocarbons are summarized in tabular form. Also presented in tabular form are data on the synthesized compounds obtained from  $^1H$ ,  $^{13}C$ , and  $^{29}NMR$  studies. A brief discussion of differences between the data found by the authors and data published elsewhere is also included. Tables 2; references 6: 2 Russian, 4 Western.

**Organothallium Compounds. Copper-Induced Symmetrization of Arylthallium Dicarboxylates in Acetonitrile**

917M0135D Moscow METALLOORGANICHESKAYA KHIMIYA in Russian Vol 4 No 2, Mar-Apr 91 (manuscript received 2 Apr 90) pp 384-388

[Article by I.F. Gunkin, A.I. Idelevich, and K.P. Butin, Saratov Polytechnic Institute]

UDC 547.583.9

[Abstract] Reduction disproportionation of arylthallium dicarboxylates in acetone has been demonstrated to be a convenient method of producing diarylthallium carboxylates. It has been studied episodically by way of the example of a number of reducing agents. The reduction symmetrization of organomercury compounds  $RHgX$  in the presence of copper has been studied in much less detail, however. In view of this fact, the authors of the study reported herein developed a new method for reduction symmetrization of arylthallium dicarboxylates and studied several aspects of the mechanism of this reaction. They synthesized a number of arylthallium bis(trifluoroacetates) and disproportionated them in acetonitrile in the presence of copper. The reaction was found to occur easily at room temperature or upon heating to between 40 and 50°C for 3 to 5 hours during vigorous mixing of the inhomogeneous reaction mixture. They proposed two alternative mechanisms of the symmetrization of arylthallium bis(trifluoroacetate). The mechanism that is deemed the more likely of the two includes radical intermediates in which copper acts as a single-electron reducing agent for the organothallium compound. Data supporting the validity of this mechanism are cited. Copper-induced symmetrization of organothallium compounds is found to be similar to the copper-induced symmetrization of organothallium compounds in that both reactions entail the transfer of an electron from copper to the organometallic compound coupled with the formation of the respective organomercury or organothallium radicals and subsequent transformation of the radicals into disproportionation products. Table 1; references 16: 9 Russian, 7 Western.

**Reaction of Organosilicon Monomers With Methyltrichloroacetate Under Conditions of Peroxide and Metal Complex Initiation**

917M0135E Moscow METALLOORGANICHESKAYA KHIMIYA in Russian Vol 4 No 2, Mar-Apr 91 (manuscript received 10 Sep 90) pp 459-

[Article by A.A. Kaymshova, Nasim Mokhammed, G.S. Zaytseva, and A.B. Terentyev, Institute of Organoelemental Compounds imeni A.N. Nesmeyanov, USSR Academy of Sciences, Moscow, and Moscow State University imeni M.V. Lomonosov]

UDC 547.245:547.465.5

[Abstract] Previous research has shown that, depending on the initiator used, the reaction of methyltrichloroacetate with 1-vinyltrimethylsilane can be directed to result in the formation of either a lactone (route a) or an adduct (route b). In the presence of  $Fe(CO)_5$  or  $Mo(CO)_6$  the reaction proceeds along route a. Adding a nucleophilic separator to the metal carbonyl suppresses lactonization, which causes the reaction to change direction from route a to route b. The authors of the study reported herein continued this line of research in an effort to synthesize functionally substituted organosilicon compounds. They did so by reacting methyltrichloroacetate with 1-vinylsilatrane and 1-vinyltriacetoxysilane. A B-adduct was formed when methyltrichloroacetate was reacted with 1-vinylsilatrane in the presence of  $Bz_2O_2$  as well as in the presence of the system  $Fe(CO)_5-HC$ . The reaction of  $CCl_3CO_2Me$  with 1-vinylsilatrane in the presence of  $Fe(CO)_5$  or  $Mo(CO)_6$  was not found to result in the formation of a lactone. The authors were not even able to achieve this desired effect by increasing the reaction temperature to 140°C. The maximum yield of adduct was achieved with the system  $Fe(CO)_5$ -hexamethylphosphoramide [HMPA]. Without an initiator present, no reaction took place between methyltrichloroacetate and 1-vinylsilatrane (at 120°C for 4 hours). The reaction of methyltrichloroacetate with 1-vinyltriacetoxysilane did not result in the formation of an adduct regardless of the initiator tried. Table 1; references 11: 5 Russian, 6 Western.



**Catalytic Reactors for Burning Out Waste Gasses**

917M0165A Moscow KOKS I KHIMIYA in Russian  
No 5, May 91 pp 32- 34

[Article by P. I. Batura, Donetsk Polytechnical Institute]

UDC 662.747.6:66.074

[Abstract] There are many methods used in purification of industrial waste gasses from organic admixtures and harmful sulfur compounds: thermal, absorption, adsorption, catalytic methods and their combinations. A review of existing reactors for thermo- catalytic purification of domestic and foreign production was presented. Most of them exhibit various deficiencies: low productivity, absence of dust catchers, high cost and batch operations. A compact, economical reactor for burning out waste gasses was developed at DPI. It is a cyclone type apparatus with radial gas inlet which is passed through a layer of catalyst. Three processes occur simultaneously in such a reactor: removal of dust from the gas, catalytic oxidation of organic impurities and heat removal. This reactor requires only 60-70 m<sup>2</sup> space for its base. The catalyst can be replaced without stopping the operation. Inexpensive catalysts were selected for this process: manganese ore, manganese agglomerate and copper-chromium catalyst. Figures 10; references: 12 (Russian).

**Novel Materials and Construction System Elements for Protection of Underground Components From Corrosion**

917M0165B Moscow KOKS I KHIMIYA in Russian  
No 5, May 91 pp 35- 36

[Article by Ye. V. Grek, Candidate of Physical-Mathematical Sciences, A. V. Zuyev, I. D. Yagmur, Yuzhnyy Giprogaz]

UDC 662.74:622.6215.620.197

[Abstract] Resistance to corrosion determines the length of the use and performance reliability of metallic underground equipment. One of the principal protection methods is based on electrochemical measures - on polarization of the component being protected by an external source of current. The so called cathode protection employs anodes from electroconductive plastic compositions. This approach was used to develop cable type anodes, the so called "flexible elongated" anodes. On the outside they resemble a regular electric cable which is placed in close proximity to the item being protected; it could be used to protect from soil corrosion and to safeguard internal surfaces of a pipeline used for transporting aggressive electrolytes. The cable type anodes are mechanically strong and can be transported without problems even across long distances; they provide uniform distribution of the protective current, they simplify construction and mounting operations and they prevent formation of eddy currents resulting in overall financial savings. References: 1 (Russian).

**Automatic Performance Control System of Primary Gas Coolers**

917M0165C Moscow KOKS I KHIMIYA in Russian  
No 5, May 91 pp 39- 41

[Article by V. G. Balanov, Candidate of Technical Sciences, B. Ya. Chekhovskoy, V. G. Pugach, N. A. Dokina, V. I. Yatsenyuk, Donetsk Polytechnical Institute]

UDC 662.74:62-776:658.56

[Abstract] Primary cooling of coke gas at the coke producing plants is one of the most important processes in the chemical products trapping section. In order to assure effective operation of the coolers, their performance must be monitored and analyzed continuously. Current control methods of the technological parameters of primary cooling of coke gas do not allow for the evaluation of each individual cooler. A computerized control system of the technological parameters (ACSTP) was developed for primary cooling of the coke gas at the Donetsk Coke-Chemical Plant and the Donetsk Polytechnical Institute. The schematic diagram of this process was presented. Total information obtained from the detectors and calculated by means of a computer program provides technological analysis of the performance of each cooling unit, comparing the performance indices in time and providing information needed for the control of cooling process of the coke gas. Figure 1.

**Dust-Free Coke Delivery Unit**

917M0165D Moscow KOKS I KHIMIYA in Russian  
No 5, May 91 pp 45- 46

[Article by Candidate of Technical Sciences A. V. Chamov, L. I. Reka, Donetsk Polytechnical Institute, N. F. Misnikov, V. M. Dyachenko, Gorlovsk Coke-Chemical Plant]

UDC 662.74.002.5:66.042.5:628.56

[Abstract] Dust and gas emissions forming during delivery of coke pollute the atmosphere of coke plants and the neighboring areas. Stationary units are used in some plants to trap these emissions, but they consume excessive amounts of electric energy and are expensive. Donetsk Polytechnical Institute designed an experimental mobile unit for dust free coke delivery with wet gas purification. The principal components and the method of operation were described. The dust catching chamber is of the liquid type with an inertia based dust catchment. The entire unit weighs about 7 tons; it can be constructed on site by plant personnel and therefore is inexpensive; about 70% of normally formed emissions are removed by this machine. Figure 1; references: 1 (Russian).

**Catalytic Purification of Waste Gasses From Organic Compounds**

917M0165E Moscow KOKS I KHIMIYA in Russian  
No 5, May 91 pp 46- 48

[Article by Candidate of Technical Sciences L. N. Aki-mova, P. I. Batura, N. A. Dokina, Donetsk Polytechnical Institute]

UDC 662.747.6:66.074

[Abstract] Coke-chemical plant emissions contain solid particles, sulfur compounds, tar droplets, naphthalene, phenols and other harmful substances. Among the numerous methods used to remove these undesirable materials from gas, the catalytic purification is the most effective one. During the catalytic purification of the emitted gasses, chemical reactions occur on the surface of the catalyst and the undesired admixtures are removed from them. Results were reported of the purification of gasses over copper-chromium oxide deposited on chamotte brick, manganese ore and ferro-manganese agglomerate. Comparative analysis of catalytic oxidation of benzene, phenol and naphthalene showed their detoxification at 85-100% in temperatures of 340-350°C, over inexpensive catalysts such as manganese ore and ferro-magnetic agglomerate. Figure 1; table 1; references: 2 (Russian)

**Reverse Osmotic Method for Purification of Effluent**

917M0165F Moscow KOKS I KHIMIYA in Russian  
No 5, May 91 pp 48- 50

[Article by Yu. A. Tarasyuk (Donetsk Coke-Chemical Plant), Candidate of Technical Sciences V. I. Korob-chanskiy, S. S. Grebennikova, N. N. Kochergina, Donetsk Polytechnical Institute]

UDC 662.74:628.56

[Abstract] Coke-chemical industrial plant effluent contain a variety of toxic substances and dissolved mineral impurities. Because of this, biological purification methods are not sufficiently powerful to provide adequately purified water for repeated use. In order to remove the residual mineral impurities the use of ion exchange resins and reverse osmosis is normally employed. In the present paper results were reported of the use of reverse osmosis as the sole purifying method. A two step purification process assured a 94-95% conversion of the effluent. The only problem encountered concerned the leakage of some water through the membranes at the point of their attachment to the pipelines. This, however, did not discount this method in principal; it appeared to be strictly an engineering problem which could certainly be solved easily. Table 2; references: 1 (Russian)

**Regulating the Degree of a Filler's Dispersion When It Is Activated by a Polymer Initiator**

917M0137E Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 57 No 5, May 91  
(manuscript received 15 Dec 89) pp 550-553

[Article by S.S. Minko, G.V. Kucher, and R.I. Musiy, Physical Chemistry Institute, UkSSR Academy of Sciences, Lvov]

UDC 541.64:541.18

[Abstract] Activating disperse materials by surface immobilization of the groups participating in the polymerization process makes it possible to synthesize a graft polymer directly in a surface layer. Disperse substances that have been encapsulated in or partially coated with a polymer film are used in polymer composites, as adsorbents, etc. The applications of disperse materials make the problem of regulating the degree of a filler during its activation by a polymer initiator an important one. The authors of the study reported herein studied this problem and determined the optimal conditions for activating the surface of disperse fillers by a polymer initiator so as to regulate the properties of the dispersions of filler in media simulating a polymerized system. Copolymers of 5-tert-butyl-peroxy-5-methyl-1-hexene-3-ine with maleic acid (0.53:0.47 molecular percent) were used as the polymer initiator. Type 6000 NM manganese-zinc ferrite was used as a disperse filler. The dispersion of the material was estimated on the basis of the optical density of its suspensions, and the dispersions' stability was assessed on the basis of the change in optical density during the process of the suspension's sedimentation. The particle size distribution functions were calculated on the basis of electrophotosedimentation analysis data. It was established that the degree of dispersion of an activated filler in a polymerized system may be effectively regulated in the stage of modifying the filler by selecting filler modification conditions based on the use of the best dispersion medium regardless of whether or not it is considered a "good" solvent for a polymer modifier and on using that dispersion method that is best for the system in the sense that it provides the maximum filler surface allowable for a polymer modifier. Figures 3, table 1; references 7 (Russian).

**Modification of Casting Epoxy Compounds for Manufacturing Polymer Insulators**

917M0170A Moscow PLASTICHESKIYE MASSY in Russian No 4 Apr 91 pp 9-10

[Article by D. V. Shumakov, A. G. Grozdov, Z. I. Salina, B. N. Stepanov, M. S. Akutin]

UDC 678.686.001.73:621.3

[Abstract] During the past few years the production of high voltage insulators made of casting epoxy compounds increased considerably. These materials consist

usually of epoxy anhydride compounds with high content of fillers and they are characterized by low shrinkage, good adhesion and high mechanical and dielectric properties. The standard compounds used in this process show a number of problems. An attempt was made to modify them by small additions (up to 5%) of a mixture of unsaturated fatty acid esters, methylphenylsiloxane and an oligomer nitrile rubber SKN- 26-1A. Overall, addition of the fatty acid mixture and methylphenylsiloxane resulted on a marked improvement of the mechanical characteristics of solidified samples. Figure 1; table 1; references: 4 (Russian), 1 by Western author).

**Use of Electrostatic Field in Manufacturing Polyimide Fluorolone Film**

917M0170B Moscow PLASTICHESKIYE MASSY in Russian No 4 Apr 91 pp 11-12

[Article by N. S. Ozerov, M. L. Kerber, M. S. Akutin]

UDC 678.766.678.743.4.02-488

[Abstract] Polyimide-fluorolone film is used in production of ribbon cables and thermally stable insulators for coiled cables; its properties are excellent but the material is rather expensive. The existing processes allow production of a stable fluorolone film of about 10  $\mu$  thickness which is not adequate for most applications. An attempt was made to develop a new method based on electrostatic field which could yield thicker films, depositing fluorolone powder on polyimide film. Experiments were performed with polyimide film PM and a powdery copolymer of tetrafluoroethylene with hexafluoropropylene F-4MB. The process is based on Coulon law and other theoretical aspects of the electrostatic field. The main elements consist of a chamber for pseudoliquefaction of the powder and its electrification, making it possible to deposit fluorolone layer up to 70  $\mu$  thick, although the optimal uniformly thick layer should not exceed 20  $\mu$ . The second stage in producing polyimido-fluorolone film is the fusion of the powder layer which must be done at a temperature range of 320-350°C. These polyimide-fluorolone films are used in systems working under vibrational conditions at high temperatures (200°C) in aggressive media. In such cases fluorolone acts a binder and assures a tight seal of the insulation. Figures 2; table 1; references: 4 (Russian, 1 by Western author).

**PVC-Materials for Electrochemical Application With Improved Properties**

917M0170C Moscow PLASTICHESKIYE MASSY in Russian No 4 Apr 91 pp 13-15

[Article by N. N. Tikhonov, I. Ye. Stavitskaya, M. S. Akutin]

UDC 678.743.22.01:621.3

[Abstract] In spite of its wide use in electric technology and in insulation of wires and cables, that use of polyvinyl chloride (PVC) materials is limited because of such shortcomings as low heating stability, combustibility and migration of plasticizers into the contact medium. In the present work plasticized PVC was modified with furan containing oligomers (FCO). It was shown that addition of FCO increased the strength and specific electric resistance of PVC materials while lowering their relative elongation at the tearing point. This modifying action of FCO is the result of a formation of a tri-dimensional spacial structure in the polymer matrix whose density is a function of the amount of oligomer and the depth of chemical reactions taking place during thermal treatment; cross-linked structures are formed with high physical, mechanical, thermal and dielectric characteristics. It was shown that by regulating technological parameters of the extrusion process, materials could be obtained with the desired structures. On the basis of these evaluations, new thermally stable materials with improved insulating characteristics were produced for electrotechnical applications. Figures 2; table 1; references: 2 (Russian).

**Highly Filled Composition Materials Based on Polyorganosiloxane With Improved Dielectric and Physical-Mechanical Properties**

917M0170D Moscow PLASTICHESKIYE MASSY  
in Russian No 4 Apr 91 pp 15-16

[Article by V. S. Osipchik, M. V. Vladykina, L. F. Klabukova, N. I. Sokolova]

UDC 678.842.046.01:621.3

[Abstract] New composition materials were developed based on polyfunctional silicon-organic oligomers and mineral fillers which exhibited improved electricity insulating properties and other physical and mechanical properties. Oligomethylphenylsiloxane was used as the binder and aminoalkoxysilane as the filler which intensified the structure formation process and regulated the properties of the composition material. It was shown that the thermal treatment of polyorganosiloxane should be carried out in two steps: first at an increased rate of heating followed by lowered temperature. Further, it was shown that aminoethoxysilanes participate actively in the structure formation processes of polyorganosiloxane; the vitrification temperature of the polymer increases by 10-40 °C while its deformation is diminished substantially and the rate of solidification increases 1.5-2.0 fold. A long term examination of various covers made from this composition showed that their electric insulating properties were retained even after long exposure to high temperatures (around 800 °C). Table 1; references: 2 (Russian).

**Investigation of Electric Insulating Characteristics of Filled Polyorganosiloxanes During Setting and Annealing**

917M0170E Moscow PLASTICHESKIYE MASSY  
in Russian No 4 Apr 91 pp 17-18

[Article by V. S. Osipchik, R. I. Molotova]

UDC 678.842.01:621.3

[Abstract] Electric insulating characteristics of filled silicon-organic polymers were investigated in a wide range of temperatures. The study was done on oligomethylsiloxane with branched structure and dispersed silicon containing mineral fillers: silicon oxide, carbide and nitride. Initial properties of the study materials were about the same. At 600 °C the insulating properties of all materials became poorer because of the destruction of the Si-CH<sub>3</sub> bonds. Heating the materials to 900-1100 °C resulted in stabilization of the insulating properties and their return to the starting levels. The strength on bending also showed a complicated behavior with temperature increase. Hence, it was shown that during the glazing process complex processes occur in the filled oligomethylsiloxane related to the formation of new structures with increased mechanical strength, producing materials with stable electric insulating characteristics. Figures 2; table 1; references: 5 (Russian).

**Production Principle for an Anti-Frictional Composition Material Based on Thermoplastic Polyurethane**

917M0170F Moscow PLASTICHESKIYE MASSY  
in Russian No 4 Apr 91 pp 18-20

[Article by A. P. Krasnov, I. K. Taratuta, Ye. A. Podorozhko, L. F. Klabukova, L. N. Malinin, V. V. Anokhin]

UDC 678.664:678.674:539.2:539.538

[Abstract] Thermoplastic urethanes (TPU) appear to be the materials of choice for application at the centers of dry friction because they exhibit high wear resistance. However, their coefficient of friction is rather high and therefore the TPU's are normally modified by various fillers. In the present work, the TPU was synthesized from 4,4'-diphenylmethanediisocyanate, 1,4-butanediol and polyhydroxytetramethylene glycol. Analysis of various study parameters showed that the TPU modified with liquid organic fillers had a lower softening temperature (evidently the modifier lowered the intermolecular interaction), lower surface hardness, lower wear resistance and higher friction heating temperature. The mineral silicate modifier led to practically the opposite results. Analysis of the data suggested that the frictional-chemical processes at the surface depend on the modifier used. Addition of fluoroorganic modifier results in destructive processes while the use of a filler leads to the formation of a "secondary" structure with improved

properties. Figures 2; table 1; references 8: 7 Russian (2 by Western authors), 1 Western.

**LDPE Based Materials With Improved Operational Properties**

917M0170G Moscow PLASTICHESKIYE MASSY  
in Russian No 4 Apr 91 pp 21-22

[Article by Ye. V. Muravyeva, M. S. Akutin, Ye. D. Lebedeva, N. G. Paverman]

UDC 678.742.23-488:539.4

[Abstract] In an attempt to increase the assortment of polymers for the use in cable industry, the low density polyethylene (LDPE) was modified with isoprene, butadiene and butadiene-styrene rubbers as well as with a butadiene-styrene thermoplastic with branched structure. Technological parameters were established for processing these modified polyurethanes. Analysis of the data showed that block-copolymers are formed during chemical modification of LDPE with synthetic elastomers during the concurrent processing, when the components melt is affected by an intensive mechanical action. This results in lower degree of polymer crystallinity and an alteration of its operational characteristic. And so the chemically modified LDPE shows higher elasticity and resistance to cracking under stress and during exposure to surface active media. Table 2; references 5: 4 Russian (2 by Western authors), 1 Western.

**Effect of Titanium Dioxide on Light and Heat Stability of Colored Compositions Based on LDPE**

917M0170H Moscow PLASTICHESKIYE MASSY  
in Russian No 4 Apr 91 pp 27-28

[Article by L. L. Khokhlova, A. B. Semenova, V. M. Logunov, Ch. B. Medvedeva, D. N. Dikerman, O. I. Gerasimova]

UDC 678.742.23.01:667.622.118.2

[Abstract] Light and heat stability of  $\text{TiO}_2$  colored cable compositions based on low density polyethylene (LDPE) were investigated along with their resistance to thermal-mechanical effects. The  $\text{TiO}_2$  content in these compositions ranged from 0.35 to 3.0 mass p. Analysis of the data showed that the greatest change in the structure of the polymer occurred after 120 hrs of illumination. The destruction of colorless composition was more extensive than that of the colored material. It was shown that the use of  $\text{TiO}_2$  for coloring cable compositions based on LDPE does not affect the light stability of the material; the dynamic thermal stability is lowered, but within acceptable limits and the paint covering power is improved. Figure 1; table 1; references 3: 2 Russian, 1 Western.

**PVC-Masticated Material With Reduced Combustibility for Cable Coating Which Prevents Spread of Combustion**

917M0170I Moscow PLASTICHESKIYE MASSY  
in Russian No 4 Apr 91 pp 29-31

[Article by D. N. Dikerman, A. N. Yelagina, Ye. A. Kitaygora, V. B. Mozzhukhin, N. S. Soboleva]

UDC 678.743.22:536.468:621.3

[Abstract] The effect of plasticizers on combustibility and basic physical-mechanical properties of PVC compositions was investigated. Diester plasticizers of phthalic, sebacic or adipic acids lowered the vitrification temperature of the material studied but increased its combustibility because of the increase of volatile organic compounds contained in the products of pyrolysis. To lower this effect, complex esters of phosphoric acids were investigated as plasticizers: tricresyl phosphate, trichloroethyl phosphate and trichloropropyl phosphate; they lowered the combustibility of PVC but at the same time diminished their frost resistance and preservation on aging. Single inorganic antipyrenes proved also to be ineffective, but their combination appeared synergistic. In the end two formulations for PVC-masticated materials were developed based on PVC, chloroparaffine, dioctylphthalate, dioctylsebacinate,  $\text{Al}(\text{OH})_3$ ,  $\text{Sb}_2\text{O}_3$  and a stabilizer. Figures 2; table 1; references 4: 1 Russian, 3 Western.

**Elastomeric Compositions With Reduced Combustibility for Cable Insulation**

917M0170J Moscow PLASTICHESKIYE MASSY  
in Russian No 4 Apr 91 pp 31-33

[Article by A. G. Grigoryan, V. E. Mikhlin, T. A. Merkulova, V. N. Voloshin, M. A. Shenker]

UDC 678.974:536.468

[Abstract] The goal of this work was to develop elastomeric compositions for electric cable insulation with following properties: resistance to flame spread, reasonably good strength, thermal stability and good insulating property. The study was carried out on combustion-resistant ethylene-propylene rubber SKEP-540 and the antipyretic filler  $\text{Al}(\text{OH})_3$ , used alone and with various modifiers: oleic acid, dimethyldichlorosilane, methylphenyldichlorosilane and metacrylic acid. Overall, the use of  $\text{Al}(\text{OH})_3$  modified with metacrylic acid with specific surface of 5-7  $\text{m}^2/\text{g}$  yielded vulcanized rubber with optimal stability towards the spread of flame and improved characteristics such as lower combustibility and lower smoke generation; their combustion products were less toxic. Tables 2; references 6: 5 Russian, 1 Western.

**Novel Materials With Improved Performance Characteristics for Manufacturing Radiation Modified Cable Insulation Articles**

917M0170K Moscow PLASTICHESKIYE MASSY  
in Russian No 4 Apr 91 pp 33-36

[Article by I. F. Gvozdukevich, V. A. Gvozdukevich, S. I. Naumkina, G. I. Ovechkina, G. P. Prodon, A. G. Sirota, E. E. Finkel, Yu. I. Firsov]

UDC 678.742.2:539.16:621.3

[Abstract] Irradiation of electric cable insulators normally improves their performance characteristics: they resist cracking under stress, resist overheating due to short-circuits and swell less in organic solvents. Two compositions were developed: 108-273 and 108-274 from low density polyethylene using available thermal stabilizers with optimal characteristics and low D values (absorbed radiation dose), exceeding in many ways the composition 102-57 developed during the 60's. In addition, searching for electric insulating materials that could be used on nuclear power stations, a new composition, 206-106, was developed based on high density polyethylene with limited combustibility. Presently the work has been expanded to other compositions based on halogen-free polyolefines. These advances will lead to greater application of radiation technology in electric cable insulating techniques. Figures 2; tables 2; references: 3 (Russian).

**Effect of -Radiation on Strength and Elastic Properties of PE + PP Mixture**

917M0170L Moscow PLASTICHESKIYE MASSY  
in Russian No 4 Apr 91 pp 36-37

[Article by V. M. Vorobyev, N. V. Zhilkina, Yu. T. Larin, Yu. S. Frenkel]

UDC 678.742.2:678.742.3:620.173:539.16

[Abstract] Effect of  $\gamma$ -radiation on physical-mechanical characteristics of polyethylene (PE) and polypropylene (PP) used as external film protectors for optical cables was investigated. Samples of pure components were investigated along with a mixture of PE and 10, 20 and 30% PP. It was noted that with increasing absorption dose, the strength indices: maximum fluidity with elongation, the strength at the breaking point diminished gradually in all samples studied, along with relative elongation at the breaking point and the elasticity modulus at stretching. The last parameter permits an insight into the change of the molecular and chemical interaction energy during radiation modification; it can be used to predict properties of irradiated polymers. Figure 1; table 1; references: 10 (Russian, 2 by Western authors).

**Technological Properties of Linear Low Density Polyethylene**

917M0170M Moscow PLASTICHESKIYE MASSY  
in Russian No 4 Apr 91 pp 37-40

[Article by D. N. Dikerman, R. A. Lashiver, A. B. Semenova]

UDC 678.742.23.01

[Abstract] A review was presented of the production processes of linear low density polyethylene (LLDPE) first developed by American companies in the 70's, followed by recitation of some of its properties. Original data was reported on comparative evaluation of two types of LLDPE: type I - with narrow molecular mass distribution and type II - with a broad one. The data were compared with the characteristics of low density polyethylene 153-10K. The results led to the conclusion that LLDPE could be processed on the commonly used extrusion equipment. Somewhat increased energy consumption could be more than compensated for by excellent mechanical characteristics of the films designed for special application (like optical cables). Figures 3; tables 2; references 4: 1 Russian, 3 Western.

**Radiation-Chemical Treatment of Water,  
Contaminated by "Hard" Surfactants [SAS]**

917M0117A Moscow KHIMIYA VYSOKIKH  
ENERGIY in Russian Vol 25, No 1, Jan-Feb 1991  
pp 15-21

[Article by S. A. Kabakchi, Ye. A. Demenkova and A. R. Bekker; Scientific Research Physico-chemical Institute imeni L. Ya. Karpov]

UDC 541.15

[Abstract] A study of radiolysis of water containing Nekal involved the use of NPR-<sup>1</sup>H spectroscopy to establish changes occurring in the SAS molecules during radiolysis and ultra-violet spectrophotometry. The products of radiolysis of the SAS included naphthalene sulfonate and mixtures of isomers of mononbutylnaphthalene and naphthalene. No products of oxidation of the SAS appeared along the ring (quinones) nor products of oxidation of the alkyl substituents (aldehydes, ketones, alcohols) at doses up to 200 kGr. The initial extent of damage of molecules of the surfactant of Nekal equalled about 2 molecules per 100 eV and did not depend upon the initial concentration of Nekal in the 40-200 mg/dm<sup>3</sup> range. The study confirmed the advisability of using radiation treatment of water containing Nekal before biological purification of the water. Figure 1; references 7: 6 Russian; 1 Western.

**Thermoradiation Effect on Heavy Oil Residues**

917M0117B Moscow KHIMIYA VYSOKIKH  
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[Article by G. I. Zhuravlev, S. V. Voznesenskaya, I. V. Borisenko and L. A. Bilan; Moscow Petroleum and Gas Institute imeni I. M. Gubkin]

UDC 541.15

[Abstract] Gas oil of Western Siberian petroleum underwent radiation-thermal cracking at temperatures of 300-400°C in doses of  $0.5 \cdot 2 \times 10^5$  Gr with simultaneous thermal cracking. Radiation-thermal cracking produced a depth of conversion 1.5-2 times greater than that obtained from thermal cracking. Radiation also facilitated desulfurization of the white oils produced. During thermoradiation cracking, radiation initiated the most power intensive stage of the process, formation of radicals ( $E_{\text{init}} = 335$  kJ/mole) while the thermal effect produced the reaction of decomposition of high molecular radicals that is the chain development reaction with  $E_{\text{bran}} = 84 + \text{or} - 17$  kJ/mole. References 12 (Russian).

**Radiation-Chemical Transformations of Amino  
Acids in Human Serum Albumin**

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[Article by N. A. Vysotskaya and V. M. Russakovskiy; Institute of Physical Chemistry imeni L. V. Pissarzhevskiy; UkSSR Academy of Sciences]

UDC 541.15

[Abstract] A study of comparative radiation sensitivity of amino acids in a protein composition used human serum albumin as a model. Radiation-chemical transformations of the amino acids during  $\gamma$ -irradiation of the serum albumin at different concentrations of protein in the presence and in the absence of an acceptor of water radiolysis products were studied. Prediction of radiation vulnerability of the amino acids during radiolysis of the protein required consideration of the amount of a given amino acid in the protein, the degree of its availability for attacks by water radiolysis products, the sensitivity of the given amino acid to radiation, including the concentration dependence of neighboring amino acid residues along the polypeptide chain and the position in the ordered structures of the protein. Secondary radicals, forming from the amino acid residues, promoted transformations of the neighboring amino acids. The radiation-chemical yields of these processes were determined. Figure 1; references 15: 12 Russian; 3 Western.

**Role of Temperature and Sizes of Samples During  
Radiation Oxidation of Polyethylene**

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[Article by A. A. Dalinkevich, A. A. Kiryushkin and I. M. Piskarev; Institute of Chemical Physics; USSR Academy of Sciences]

UDC 541.64

[Abstract] A study of the effect of temperature and sample sizes on polyethylene oxidation, induced by X-radiation used 120 + or - 5  $\mu\text{m}$  thick polyethylene film. The films underwent irradiation on an X-ray unit at 2 values of maximal energy of the bremsstrahlung  $E_M = 43$  and 70 KeV. The absorbed dose rate of irradiation was measured independently by a ferrosulfate dosimeter and an ionization chamber. Irradiation was performed at an absorbed dose rate of 0.058-20 gr-20 Gr at 293-353°K. The major difference between radiation oxidation of polyethylene and other forms of initiated oxidation was the increase of depth of penetration of the oxidation reaction in the polymer with an increase of temperature. This difference was associated with the lower value of effective energy of activation of oxygen diffusion. Since the effective energy of activation of oxidation of the

interior layers of the block approximated the energy of activation of oxygen diffusion in the polyethylene, the value  $(k_p/D)^{0.5}$ , determining the form of distribution of concentration of oxygen-containing groups with distance from the surface, did not change with temperature change. References 18: 15 Russian; 3 Western.

#### **Photothermooxidative Destruction of Nitrocellulose**

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[Article by A. T. Govorkov, A. M. Gzogyan and V. V. Ovcharenko; Kemerovo State University]

UDC 541.14+535.34

[Abstract] A study of the kinetics of destruction of nitrocellulose in air and in a vacuum under individual and combined effect of high temperatures and ultra-violet light was described and discussed. The energy of

activation of processes of destruction of nitrogroups and accumulation of carbonyl groups were determined. The main difference in the course of thermooxidative and photooxidative processes in nitrocellulose was described. Three basically different regions (photochemical, photothermochemical and thermophotochemical regions) appeared under the combined effect of ultra-violet light and heat. The 1st region involved temperatures at room temperature and below in which the role of "dark" processes are insignificant and nitrocellulose destruction is determined only by the number of absorbed quanta. The 2d region is the region above room temperature. Photochemical processes play an important role in this region and "dark" processes amplify destruction due to increase of vibrational energy of atoms, an increase of probability of conformational transformations of the pyrane cycle and increase of the rate of diffusion processes. The 3rd region is a region of thermophotochemical processes in which "dark" processes play a great role and products of photochemical reactions catalyze thermal dissociation of nitrocellulose. References 15: 14 Russian; 1 Western.



**Gasification of Coal in Water Vapor Plasma**

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bx;1pp 76-80

[Article by I. B. Georgiyev and B. I. Mikhaylov; Scientific Research and Technological Institute "Minproyekt"; Sofia; Bulgaria; Institute of Thermal Physics; Siberian Department; USSR Academy of Sciences]

UDC 622.732/622.61.12

[Abstract] The article described and discussed creation of a plasma-chemical installation which imitates the

action of basic units of industrial installations for gasification and described experiments performed on it. The device performed steam-plasma conversion of solid fuels at a capacity up to 50 kW. Steam-plasma gasification of high-ash and high-sulfur lignite coals was studied at temperatures above 2400 K. Parameters and balance of the process was described. The content by volume of carbon monoxide in the gas reached 37.2 percent and that of hydrogen reached 61.6 percent. Experiments showed that gasification processes in the heterogeneous phase may proceed only in the temperature interval from 1000 up to 1650 K. The study showed that, from a technological point of view, steam-plasma gasification is quite feasible. A block diagram of the device was illustrated and discussed. Figure 1; references 12: 11 Russian; 1 Western.